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Bombax discolor

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Arboretum Activities

THE STAFF

On January 9 and 16 the Director conducted clinics under the auspices of the Pennsylvania Horticultural Society on the topic "Botany for Gardeners" and on January 22 he addressed the members of the American Herb Society, of which he is President-at-Large, at their winter luncheon meeting which was held at the College of Physicians in Philadelphia. On January 25 he spoke on, "Exploring for Drug Plants" at the annucal Garden Forum of the Ambler Junior College and repeated this lecture on February 11 at the University of Delaware and on February 17 at the Chestnut Hill College for Women. At the seminar of the University's Department of Biology on February 13 he spoke on "Studies in the Pennsylvania Flora." He addressed the Men's Garden Club of Delaware Valley on February 19 on the topic "Plant Exploration." On March 4 he gave an illustrated lecture entitled "The Road to Mandalay" to the Twin Greek Garden Club and on March 12 he gave an illustrated talk before the Cosmopolitan Club on the topic, "Spring in Philadelphia."

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A Mycologist In Ecuador

Patricia Allison

"Do you know of a mycologist who would be interested in teaching at the University of Guayaquil, Ecuador this summer?" The letter came in the first week of May. "Yes," I responded in the same week, "I." The inquiry came from the head of the department of biology of the University of Houston, Dr. Sara Huggins. The chemical engineering department of that university had had a government-sponsored cooperative project with the University of Guayaquil for some time, but biology was not included. The word had come nevertheless that the fifth year students of the Escuela de Ciencias Naturales wanted very much to learn something about the fungi.

I had long been interested in Latin America but Ecuador was a long way from home and my Spanish had once failed me when I had tried to buy a railroad ticket in Mexico City. It was important to know whether or not the warm feeling for Latin America that had grown since my first trip there with Dr. Fogg was engendered by the thrill of new sights and travel, bolstered by subsequent trips to Mexico and Central America with my family, or was indeed a genuine affection for people of my hemisphere about whom I had been too long ignorant. There are not many opportunities in our individual lives to exercise the sort of citizenship we somehow feel is the heart of our nation's attitude toward our foreign friends. It became perfectly clear somehow that this was the time and this was the opportunity to distinguish between fact and fantasy.

Telegrams flew from Philadelphia to Houston and cables from Houston to Guayaquil. At last the word came. I had obtained my passport, visa, the air tickets, and all was in order. Thanks to the generosity of the University of Pennsylvania, I was able to ship by air my microscopes and lamps, a skeleton set of specimens, cultures, and microscope slides, as well as basic materials necessary for the culture of fungi. A friend at the arboretum had agreed to look after my dog; my graduate student had promised to work, as only a graduate student can; Dr. Fogg's assistant for the summer agreed to live in my house, and Dr. Fogg himself assured me this trip was an opportunity that should not pass by. A month after receiving the first letter, I arrived in Guayaquil. All during the flight, I wondered where, really, I was going.

The Maya and Aztec cultures had intrigued me for some time but I never thought that I would be entering the land of the Incas and I had never even hoped that I would have an opportunity to visit for professional reasons a land so rich in variety of natural habitats for all things living, or a more suitable base of operations than Guayaquil.

Guayaquil

Even before it was definite that I would be teaching at the University of Guayaquil, I had exchanged letters with the American botanist there, Amy Jean Gilmartin. She not only advised me as to the proper clothing to bring but also had made efforts in vain to locate text books of mycology in Guayaquil and Bogota, Colombia as well. I looked forward to meeting her.

Adventures are instantaneous in Ecuador and began the moment I stepped from the plane in predawn. The first adventure was to learn that all the words of Spanish had suddenly fled my mind; the second was to learn that I had the wrong sort of visa that resulted in the confiscation of my passport; the third was to discover marvelous companions and colleagues in the Gilmartins, for it turned out that she, the expert on bromeliads, was married to Dr. Gilmartin, oceanographer, who had been studying the plankton of the Gulf of Guayaquil for many months. It was they who convinced me that limping Spanish could be made to walk and who introduced me to the wonderful spirit of the fifth-year university students of the Escuela de Ciencias Naturales and to the country. Indeed, my first meeting with my students was not in the classroom at all but at a typical "coctel" and dance at the Gilmartin's. As that evening approached, I though of another typical Latin American gathering that involved the well-known moment of truth. I was afraid that I would soon be minus my ears. None of it. That first evening epitomized all of the days I was to spend with the Guayaquileños. As eager as I was to teach them some of the wonders of the world of the fungi, so were they eager to learn. As ardent as was my wish to be understood, so was theirs to understand. Helpfulness in every way characterized the wonderful citizens of this strange city.

Fig. 1. View from Dining Room

I lived in a pleasant room in a modern building near the center of town. The small pension occupied two floors and was complete with dining room whose small balcony overlooked the street (Fig. 1). From the bedroom windows, I could see by day into the inside of a typical city block in downtown Guayaquil. Although modern concrete buildings faced the streets, the heart of the block housed the workers who serviced those buildings. Their dwellings were of corrugated iron and bamboo which opened on a cobblestone courtyard. Their children, their dogs, their cats, their hens, and their roosters played there. By night, although my eyes could not detect their presence, my ears absorbed the vital symphony of their lives. Guayaquil is not a quiet city. No automobile ever dies there without its every part having been exercised and made vocal. No cat ever survives there unless it makes its nightly rounds. No rooster ever spoke a richer tongue, and no Ecuadorean ever dies who has not danced a million miles. If there is an indigenous craft in Guayaquil, it is to dance, and the nights throb until morning with the wonderful rhythms adopted from other lands. It is only when spirits flag and the frenzy's ending that the haunting, melodic, unforgettable music of the Ecuadorean highlands at last sends all to rest.

One soon became accustomed to these sounds of life and felt well encompassed and at home. Furthermore, all that was needed was a trip or two in the wrong direction on the right bus to acquaint one with some of the surrounding areas of the city. Just as there are rich houses with quiet lawns in every large city, so also are there poor ones with no lawns at all. In Guayaquil, these are made of slit bamboo and stagger up the hillsides above the river or cluster about the market places. Some of them are surprisingly clean and others appallingly dirty. (There is less formality about certain habits in most of the city than one might expect.) Of particular delight were the many tiny gardens. These were usually punctuated by a statue of some political hero, but were impressive because of the meticulous care given each scrap of lawn, each tiny border of croton, each delightfully sculptured design wrought in hibiscus. Before 1900, a mycologist collected fungi in the botanic garden of Guayaquil. This garden no longer exists.

The University of Guayaquil

The physical plant of the university, its administration, students, and staff are scattered about the city. The Escuela de Ciencias Naturales is one of the youngest of those of the Faculty of Chemical and Natural Sciences and occupies a reconstructed private dwelling. Because there were no laboratory facilities there, my classes were held in another part of the city in a large building occupied by the faculties of chemistry and medicine. I was told that the building was constructed in the early forties, by the Red Cross as a hospital in anticipation of possible war-time casualties. Its cavernous rooms had fifteen-foot ceilings, and walls with large openings that would permit air-flow during the terrible rainy

Fig. 2. Old Guayaquil from the University

Fig. 3. Promontory

season. The doors and windows of these laboratories faced open-aired corridors. From these one could look out over old Guayaquil on the hillside or down into the street where election signs covered walkways, factory walls, and even the walls of the Facultad itself (Fig. 2).

The dean of the faculty, Dr. Alfredo Quiroz Salcedo, could not have been more kind. On short notice and against all traditions of the Latin pace, he succeeded in having a large laboratory cleaned, painted, and illuminated for the class in mycology. In addition to this, he personally assembled many of the necessary supplies for laboratory work that the university storerooms lacked. I was glad that I had taken to Guayaquil certain supplies because some of them were not at all available. On the other hand, some materials were present in astonishing abundance and the conclusion could not be avoided that various manufacturers in the world were taking advantages of funds supplied the university from external sources. The microscopes, for example, were superb, but there were no appropriate microscope lamps and no appropriate area for protection of optical equipment from humidity and dust. There was an assortment of laboratory culture media but no functioning steam sterilizer. There were instruments in original packing boxes that had never been assembled and whose accessories were scattered or broken. There was no hot water, for which I was greatly sorry at first, until I came to know that there was no water at all a good deal of the time. Conditions have improved enormously since the initiation of the University of Houston Project. A lot of duplication in instruction is being eliminated, and it is hoped that most of the students majoring in subjects that would ordinarily be studied in a College of Arts and Sciences will soon attend classes in the new University City.

I will be the first to attest that there was no lack of interest on the part of my students. It was the students who assured me, afer the military junta took over the national government and closed the nation's universities, that the classes in mycology could continue without fear of rioting. "After all, it was only the national government which closed the universities and not the students themselves striking." So while others enjoyed prolonged vacations, the intrepid mycologists convened. I only wish such enthusiasm could have fed on richer nourishment. The seven American text books which I had taken with me were the only ones available in the city. These were shared by fifteen students whose work schedules and difficulties with English imposed restrictions. There were no journals available. Indeed, the only subscription to Biological Abstracts in all of Guayaquil had been suspended by a political appointee who headed a federal institute in town. It may have been just as well for this class because they needed first-hand experience in the laboratory more than anything else.

The fullest comprehension of the enormity of Ecuador's problems came from experiences at the university and conversations with its faculty. The realization is certainly not based on an assumption that talent is lacking there or that the organization of the institution is different from ours and therefore wrong. Rather it is founded on the discovery that impulses to improve the intellectual resources of the nation are overwhelmed by burdens imposed by tradition and by the interference of frantic politics in academic affairs. Tradition dictates that there be a disproportionate number of part-time faculty members. Men whose full-time efforts might stabilize and improve the quality of instruction are obliged to divide their attention between two or three jobs in order to support their families.

Fig. 4. Desert scrub

Fig. 5. *Prosopis* sp.

There are too few opportunities for academic careers as we know them. The politics are not only those of the nation as a whole, but of the university itself. The principal academic officers, including the rector, vice-rector, and deans, are elected. The terms of office, until recently, were for two years, although an individual might be re-elected. As if this were not sufficient to dampen ambitions to assemble and lead a distinguished faculty, one aftermath of the recent revolution was a change in the rules which now prevent re-election. And so, at present, continuity of work in a deanship depends on only three or four hours a day for three years.

The Lay of the Land

The interval of a mere month before departure allowed only the most cursory study of the sights I was about to see, and detailed maps of Ecuador were not available in Philadelphia. Nevertheless it was obvious from the start that this was one of the most fascinating countries of the globe for a biologist of any sort. Although Ecuador, on a map of South America, appears insignificant in size compared to other, better known giants, it is by no means small. It shelters within its boundaries an assortment of topography and natural habitats that could not help but replace some of the fear of strange places, peoples, and language with the most intense anticipation and excitement.

The Ecuadoreans proudly refer to their country as Ecuador Amazónico in spite of the fact that a great deal of their land in the Amazonian basin now is part of Peru. The republic is about four times the size of Pennsylvania and most of it lies just beneath the equator directly south of Pennsylvania. Indeed, Guayaquil, like the Panama Canal, is practically due south of Pittsburgh. The country lies athwart the grand double cordilleras of the Andes. To the east of these high rows of mountains, the slope is gentle and prolonged, terminating in the two splendid river systems of the Rio Napo and the Rio Pastaza that course through the western jungles of the Amazon. Little is known of the real geography of the Oriente, as this section is called, and even the best modern maps of this part of the world bear but polite suggestions. It is in this area that the fierce Auca tribes live.

The Andes shelter a high valley in which the capitol, Quito, lies to the north, and several other major settlements southward. Some of the highest peaks of the western hemisphere wall in this valley. The altitude of the valley itself is over 9,000 feet.

One certainly cannot say that the western slope downward from these grand heights is gentle — quite the contrary. Foothills, as we know them, are all but absent. The mountains seem to rise from the flat agricultural land like jagged icebergs rising from the sea. This precipitous side of the mountainous spine of Ecuador lies less than one hundred miles to the east of Guayaquil and was of especial interest to me because it meant that there would be an abundance of diversified habitats only a short distance from home base. I soon learned, however, that it was not necessary to travel even that distance to be impressed with Ecuador as a land of biological wonders. Guayaquil, for example, lies at the mouth of the Guayas River that drains southward into its broad gulf. Along its tributaries to the north lie rich, moist agricultural lands. To the west, how-

Fig. 6. *Bombax discolor*

Fig. 7. Flower of *Bombax discolor*

ever, one can experience during an afternoon's jaunt to the seashore, a succession of abruptly changing vegetation types that reflect impressive differences in environment.

Between the area drained by the Guayas River system and the sea, there is a range of hills that in places reaches altitudes of over two thousand feet. Portions of this range thrust southward between Guayaquil and the Santa Elena Peninsula directly to the west. Indeed, a finger comes very close to Guayaquil itself. In traveling to the sea, then, it is possible to get glimpses of swamps along the gulfside streams, of the mesic woodland of the hills near Guayaquil, of the savanna, and finally, of extensive desert scrub and of the cactus bordering the promontories that scallop the seashore. Far, far to sea and a degree or two northward lie the westernmost portions of Ecuador. These are the renowned Galapagos Islands. Somehow it seems strange that the islands, so important to basic biological discovery, should attract biologists time and time again without their ever coming to realize the staggering richness of the invitation that the mother country also extends. Compared to most other nations of South America, Ecuador is little known biologically. Because of Dr. Gilmartin's interest in the sea and other water ways, mine in the fungi, and Mrs. Gilmartin's in bromeliads, the trips we took together allowed me to see most of the habitats mentioned.

From the Sea to the Sierra

The ocean itself is one of Ecuador's most valued resources, for much of the world's tuna is harvested there. Because of the rich effluent of the Guayas River, many other forms of sea life prosper and support large populations of birds. The shore itself is rich with cast-up algae, shells, star fish, and soft corals. The latter grow only a few yards from shore and supply brilliant color in an otherwise relatively drab environment. An ancient uplifted sea floor forms rugged promontories, one hundred or more feet high, that carve the beaches into interesting coves. Tall, spiny cacti at their summits are silhouetted against the gray sky characteristics of June and July (Fig. 3). Although much of Ecuador experiences a wet season, just over, it is nearly always dry in the sandy flats inland from the sea. Besides cactus, the landscape is dominated by low thorny shrubs such as *Maytenus* and *Scutia maritima*. Even though there is very little rain in this area, there probably would be more vegetation were is not for over-grazing (Fig. 4). Farther inland, the sparse scrub gives way to the savanna, dotted with small trees, such as *Prosopis* spp. and *Acacia,* and by tangled herbaceous weeds and grasses. There is an astounding variety of leguminous plants of every life form (Fig. 5).

On the slopes of the low hills, farther eastward, where rainfall is a little more abundant, there is an abrupt change toward more mesic woodland. Here the trees are larger and the farms more fertile. The interesting shrub of the Olacaceae called "mollullo" was in beautiful yellow flower. It mucilaginous fruits are sources of glue. The magnificent "ceibo" tree (*Bombax discolor*) towers in smooth-barked strength above all other living things. Most of them were leafless, but many were in flower and some bore fruit as well as flowers and leaves in portions of their massive crowns. They also can be found close to Guayaquil where the woodland is much richer. (See Cover, Figs. 6 and 7).

Fig. 8. Mangroves near Data

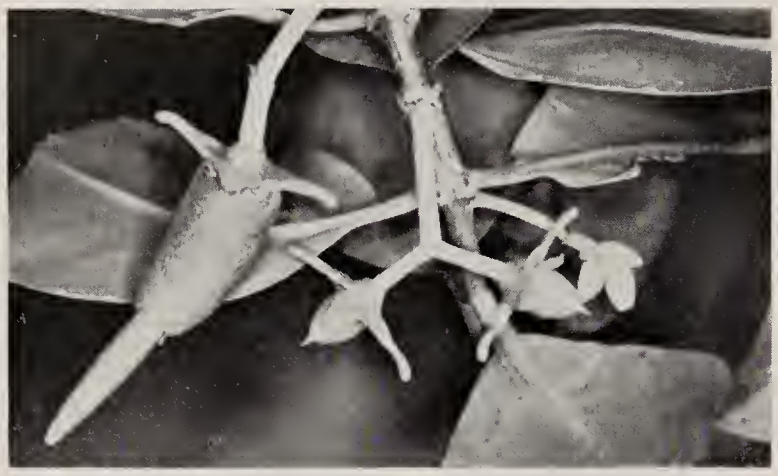

Fig. 9. Mangrove flowers and fruit

It was on the steep sides of the hills near Guayaquil that I made my first collections of Myxomycetes. They were species common also at the Morris Arboretum, but somehow finding them amid the strange jungle-like vegetation, hearing the rattle of some animal's hooves on the rocks of a small stream in the tangle below me, made collecting them exciting. Nearby I found species of Ascomycetes that I had never seen before.

I had little opportunity to examine the lofty mangroves (*Rhizophora mangle*) in the swamps that border the Gulf of Guayaquil, but from the oceanographic vessel, I could appreciate the tangle of aerial roots and rich greenness of the foliage. At the mouth of the gulf, near Isla Puná, however, I had at last the chance to cross the mud flats and search the bark momentarily for fungi. There the trees were smaller but they were in flower and fruit (Figs. 8 and 9).

Just as the mangroves might occur in isolated patches, so also are there other astonishing contrasts near the sea. At about one degree, forty-five minutes south, the beaches are long and exceedingly smooth at low tide. This permitted easy traveling by Land Rover to visit the famed 'Garua' forest. A portion of it lies less than three miles from the sea. Between it and the sand is the richest of all cactus woodlands (Fig. 10). As the altitude increases slightly in the coastal hills, the soil changes also. Even though the dry season had begun, the clay roadway was wet and slippery, for these hills are kept moist by fog-like mists formed when the moisture of the winds from the southwest condenses on the hills. We stopped the car only a few hundred yards inside the area because the road had become so slick. Only minutes before we had negotiated the deep sand in a seaside village street.

A bank descended steeply from the road into a wild tangle. Here I saw my first example of the Panama hat tree, *Carludovica palmata* (Fig. 11), and here I collected nine or ten species of Myxomycetes as well as a number of other extremely interesting fungi. As if this were not enough to make one happy, the brief visit was climaxed by an opportunity to observe hordes of leaf-cutting ants bearing their burdens across the clay road, down the bank, and off into the brush. So many millions of tiny feet had trod the same path that it was visible from a distance of fifty yards. Nearby, the path was four or five inches wide and perfectly smooth. As I traced it with my eye into the woods, I saw smaller tributaries join it in the distance, each atwinkle with slivers of green borne on the backs of the staggering harvesters (Fig. 12). It was with considerable disappointment that we departed this interesting fog forest. The fungal collections had all been made in an area of only a few square yards. What others might have been found had there been more time before the returning tide erased the road homeward? The short journey back to the beach permitted a second glimpse of other aspects of the countryside. The anomalous weather permits the growth of jungle, to be sure, but it also allows the cultivation of tropical fruits and fiber plants. Even the interesting tagua, or vegetable ivory palm, *Phytelephas aequatorialis,* grows there.

Fig. 10. Cactus woodland between ocean and garua forest

Fig. 11. *Carludovica palmata*

Much more abundant croplands exist in the wet "litoral", the lowland lying north of Guayaquil between the coastal hills and the western cordillera of the Andes.

One has only to sit at the dining table to appreciate the marvels of Ecuadorean agriculture. Papaya, banana, pineapple, and the delectable juice from naranjilla fruits (*Solanum quitoense*) are superb. The chocolate is recognized as the best-flavored of the world. Rice, interesting corn varieties, and yuca (*Manihot utilitissima*) are staples. More interesting still is it to wander along certain streets of the city where coffee, cacao, and rice are strewn to dry, or into the markets where an overwhelming display of comestibles is spread. Watching the activity of the broad river is even more intriguing, however, for it offers an invitation to visit the part of the country where these and many other products originate (Fig. 13). Flotillas of rafts bring balsa wood down to the port; ocean-going ships load for commerce with the world; mighty grain elevators store the wheat harvest of the highlands.

El Litoral

A number of trips were made to the principal agriculture area and into "exuberant" forests (Fig. 14) of the upper tributaries of the Guayas river. The first was with the university students, when we visited the agricultural experiment station, Pichilingue, near Quevedo. and a very satisfactory field trip it was. Not only did we find fungi in great abundance and variety in the neighboring jungle, but also examples of plant diseases at the experiment station which are the grave concern of much of tropical Latin America. Sigatoka, a fungus-incited disease of banana leaves (Fig. 15), is the most serious hindrance to production of this all-important crop in Ecuador at present, although an even more dread fungus, that causing Panama Disease of banana has been found recently in other areas. This is the fungus that has changed the way of life for much of Central America. Admirable work in cacao breeding is being done at Pichilingue, for this plant too is subject to the attack of a number of serious fungal pathogens. These fungi have reduced the export of cacao by about three-fourths. Because of the excellent flavor of Ecuador chocolate, however, every attempt is being made to restore the plant to preeminence in agriculture.

Although a number of Myxomycetes were collected in and around the experiment station during the visit with the students, a return trip was arranged so that a couple of days could be spent in search of those tiny, fascinating fungi. It turned out to be an international foray, as I was accompanied by an Ecuadorean plant pathologist stationed at a nearby banana experiment station maintained in cooperation with France. The night was spent at the Pichilingue guest house managed by the German wife of the director of the station. Because of the shortage of rooms I was asked to share space with a young sociologist from the United States. Imagine my surprise in learning that she had attended college for a year in the Philadelphia area and was well acquainted with a student of mine at the University of Pennsylvania.

This surprise was not nearly as great as that of two machete-bearing hunters who discovered a foreign woman staring at stumps in their part of the forest. I had not noticed their arrival because I had just found an amazing array of Myxomycetes and was busy gathering them. Pleased as I was, I could not help offering my hand lens to these strangers so that I could give them a

Fig. 12. Leaf-cutting ants

Fig. 13. View along the Guayas River

glimpse of my world just as they had allowed me to see theirs. The leader of the two thrust his machete into an enormous fallen log nearby and stared through the glass at the bit of wood I offered. So great was his delight in viewing the unknown inhabitants of his province that he refused to share the pleasure with his companion, saying that he was "only a worker" and was not permitted to view such things.

These trips made me appreciate more fully the changing countryside between Guayaquil and Quevedo. On the low hills to the north of the city the leafless small *Cochlospermum* trees dominated the landscape with their abundant yellow flowers. The highway passes through a portion of the grassy savanna where a few cattle are raised, then enters the extensive "litoral", which is nearly all farm land. Rice, sugarcane, papaya, and yuca are common crops. There are patches of tall trees amongst which is the splendid palo prieta, whose masses of salmon-colored flowers made the distant view of the dark forest a peculiar mixture of pink and green. Dense,

Fig. 14. 'Exuberant forest' of the litoral

towering thickets of bamboo are common, for this plant supplies most of the building material of the area. The canes are six to eight inches in diameter, and serve not only as framing wood for houses but also for siding and flooring, after they have been made flat by numerous slits (Fig. 16). The tall canes also support banana trees laden with heavy fruit. In small villages where concrete yards cannot be afforded, the slit bamboo separates the drying rice, coffee, or cacao crop from the earth. Just as in the city, the grain is spread out each morning, turned during the day by foot, then stored again for the night.

The most extensive banana, cacao, sugarcane, and coffee plantations are not far from the broad Rio Daule. In places along the highway it is possible to look across this broad tributary of the Guayas and see the cloud of moisture hovering over large banana plantings (Fig. 17). During the

Fig. 15. Sigatoka of banana leaves

dry season when the level of the water is low, the sandy banks are utilized for the cultivation of tobacco. On the steeper banks deep tangles of thorny legumes and saw-toothed grasses shelter the barren shoreline where water fowl and giant iguana bask. The journey from Guayaquil northward was always interesting, but never was it as exciting as during one of our journeys to the Andes.

Up the Slopes to the Páramo

The main highway to the northern cities of the high valley of the Andes goes northward through the litoral to Quevedo then eastward into the mountains. There were check points on many of the highways we had traversed in the past, but because the vehicles we used bore government license plates, we never had been stopped for tolls or searching. The military junta had been

Fig. 16. House under construction in the litoral

in power more than a month and the revolution had ceased to occupy much of our thought. It was therefore petrifying to have rifles thrust into our faces at the check point in Quevedo. We were ordered from the automobile which was then swarmed over by soldiers. A long sheath knife was taken from Mrs. Gilmartin who could not bear to part with this prized piece of a field botanist's equipment. Her objection was firm as one could be. She grabbed it back which, needless to say, startled and displeased the group of soldiers about her. At this instant the ammunition of Dr. Gilmartin's automatic was found in the car. Dr. Gilmartin assumed all the command, real and imaginary, possible when surrounded by a dozen angry soldiers speaking with unfamiliar accents, carrying rifles whose muzzles seemed six inches in diameter. He grabbed from his pocket the completely invalid permit to carry firearms issued by the deposed government. He demanded the return of the ammunition. When refused, he imperiously requested the name of the corporal who would do such a foolish thing and the name of his commanding officer who surely would deal with such a fool. These in his possession, he ordered us back into the automobile and we drove off at as smart a pace as the rutted roadway would allow. Not far from the town, we paused and breathed once again. Thanks to the instantaneous reaction of Dr. Gilmartin, they had not found the gun itself. The thought of another search on our return trip through Quevedo haunted us. Surely when that corporal deposited that ammunition on the desk of his superior, he would be asked but one question, "Where is the gun?" Would they be waiting for us on the return?

Soon the excitement of the ascent into the sierra consumed our interest. At the lower elevations, there were continuations of the farms of the litoral. The varieties of banana, however, were quite different from those below. Not long after the real climbing began, we stopped for lunch where the highway crossed a glittering rocky river that came from the heights. Nearby was a small house. On one side of the stream a clearing had been planted to banana. A young Ecuadorean and his children were busy by the water. Dr. Gilmartin moved upstream a bit to try his luck with fly rod. Mrs. Gilmartin scouted the nearby jungle for bromeliads, and I turned my attention to the stream itself. Not far from the bank was a leafy wier made of short sticks and banana leaves. It greatly impeded the water that otherwise would have flowed through a small rocky channel, along the grassy bank, and back to the main stream below. I couldn't imagine what its purpose was. The Ecuadorean had disappeared, although the children were still by the river. A few minutes passed before he returned carrying a deep basket filled with leaves. This was deposited on a sandy bank while he and one of his boys moved to a thicket to cut with their machetes a couple of stout poles. The father then shaped the ends like chisels, and with his machete began to dig a small, deep pit in the wet sand. He had no sooner packed the leaves into the hole and begun to macerate them with muscular thrusts of the long wooden chisel, than it dawned on me just what the significance of the little dam in the stream was. This family had begun the long process of harvesting food from a river by stunning the fish with rotenone from the leaves of a plant native to the area. (Probably a species of *Erythroxylon*) I was too late to get samples of the leaves for identification, but not too late to study the way the leaves were pummeled in the hole in the ground, mixed with sand, and put back into the large basket. A glance downstream then revealed several more minor dams made of leaves. The plan was to douse the basket up and down in the water just below the first of the series so that the fish poison would permeate that portion of the river that

Fig. 17. Banana and tobacco beside the Rio Daule

Fig. 18. *Cecropia* sp.

lay between the two blockages. I watched excitedly as the water turned green from the ground leaves, and the family clambered over the slippery rocks to catch sight of the first flopping fish. Along the shore the father kept close watch among the grasses, for stunned fish headed toward them as fast as they could. The effect of the drug was transient, however, and frantic efforts were made to stun them still further by slapping the water with machete as soon as they were sighted. Despite the fact that this was a large stream, and the man had labored through the morning and into the afternoon building the dams and preparing the poison, the catch was miserably poor. About two pounds of small fish landed in his basket. When asked why the take was so meagre, he told us that someone either poisoned or dynamited the river for fish every week or ten days. At that, his catch exceeded that of the oceanographer with his rod.

As the sides of the mountains steepened, the natural vegetation became more and more predominant. The few houses we saw were not constructured of cane and banana leaves, but of timbers harvested from the dense forests. Soon the sunlight gave way to shifting clouds. The roadway was now illumined, now obscured. This was the tropical rain forest — dense beyond imagination, laden with vines that hung in woody curtains from the trees of enormous heights. When a shift of the clouds would permit a view down the steep side of the mountain, we could see specimens of pale-barked balsa o'er-topping the other forest trees. We took turns climbing into the forest for the roadway was soon lost from sight. The sometimes rocky slopes were dangerously steep or fell as cliffs about a hidden gorge. This slanting forest floor was wet and rich in humus and fallen logs. It seemed a paradise for the organisms I was seeking. Although I encountered a number of higher fungi, finding the tiny ones that interested me most proved to be impossible while clinging to vines or rocks and avoiding the numerous spiders and beetles that resembled nothing I had seen before. It somehow seemed more rewarding to enjoy the absolute wonder of this magnificent forest than to search, nose to ground. I hated to leave the ever changing panoramas that the shifting clouds revealed. Now a dark *Cecropia* was thrust against the backlit gray (Fig. 18). Now it was swallowed, and a whole mountain side illuminated. The tumult of an invisible waterfall could be heard and a sudden shaft of sunlight glistened on a jade green pool. The world had vanished and in its place was but an ever-changing dream. We saw no sloths; we heard no birds. As we ascended the slopes of the first range, the clouds assailed the mountains and tumbled through openings between peaks as shifting white rivers into the valleys beyond. The luxuriant growth of the rain forest gave way gradually to more scattered and shorter clumps of trees. Nevertheless, the abrupt change was startling on the eastern face of the ridge. Even at the borders of the rain forest, we had been impressed with how dry the roadway was. Shrubs were gray with dust, twigs were brittle, but this did not prevent one from being further struck with the fearful dryness to the east.

Fig. 19. Highland farm

Fig. 20. Bromeliad-covered tree

Near an abandoned adobe and thatch dwelling by the side of the road we saw a pitiful field of wheat. Its sparse stems waved as wheat does in the winds, but there would be no harvest. Half of the developing grain was already destroyed by one of the smut fungi, and the field was arustle with the voracious activities of a swarm of grasshoppers that would consume the rest. The highland farms, despite soil that is in some places six feet deep, cannot support the struggling Indians. Even though richer bottom lands on the eastern side of the sierra have been offered to them, the depauperate souls will not abandon their mountain homes. The beautiful sad songs of the sierra come from these people.

When we were in the midst of the rain forest we were all alone. Above it, the only signs of moisture were the clouds cast backward by the first row of mountains, and the white rivers that crept between — and we were not alone. As far as the eye could reach downward toward unseen valley floors or eastward toward opposing and higher mountains, there were farms. Each cornstalk house was engulfed by its view (Fig. 19). The same abrupt changes in vegetation and climate occur all along the western cordillera but at varying altitude.

On this trip, our destination for the night was the town Pilaló. This is a small settlement at about 10,000 feet in a surprisingly flat little valley around which the mountains rose sharply. Mrs. Gilmartin had visited the town several times in the past and was eager to enter some of the richest bromeliad country we had seen. We had passed areas on our way to Pilaló that had impressed me greatly not because I was fond of bromeliads, those "cabbages in the sky", but because I had long been led to believe that they in no way harmed the trees on which they perched. As a plant pathologist, I must say that I no longer entertain this view. Perhaps it is mere coincidence, but those trees most covered with them were also the unhealthiest (Fig. 20). While she pursued her collecting, Dr. Gilmartin and I returned to the car to drive still higher into the mountains in order to catch a glimpse of the páramo. As we climbed upward toward 13,000 feet, the countryside again underwent a drastic change. Trees could be observed only at levels far below us. Instead, the earth seemed barren and straw colored. A cluster of houses made of grass looked like huddled sheep dogs (Fig. 21). On slopes far below, we could see an occasional llama or shepherd in bright red or blue wool poncho. The only spots of greenery were those about the huts from a few stunted trees and a nearly continuous moss-like mat of rosette-formed plants on the bank of the roadside. It was very cold. This was the páramo, xerophytic grassland above timber line.

We stayed at the Hotel Nuevo (Fig. 22). The broad front door of this establishment opened on the highway. There were two large dining rooms beyond and a small pool room to the right. The hotel had two rooms for guests. To reach ours, we passed through the other. Each of us had a narrow steel cot. In the other room there were six or seven of the same sort of beds. Night

Fig. 21. Grass huts of the high páramo

Fig. 22. Nuevo Hotel

brought no surcease of adventure. Despite the excitement that the day's happenings had brought to us and the pleasant fatigue that our scrambles had bestowed, the entertainment was only beginning. This was the night of all nights for the proprietor. His eldest daughter had just graduated from high school and friends and relatives poured into the hotel to join in celebration. For a while I thought I was back in Guayaquil on a Saturday night except that this music was much closer and we could hear feet on the floors. As the night wore on, we hopefully awaited the sounds of the sierra music that we had come to expect at the end of every party, but it never came. We arose in the morning, crossed the other bedroom where countless bodies lay in exhausted disarray, had our breakfast, purchased a lunch, and headed back for Guayaquil. Bromeliad hunting had been good, and interesting bundles had been tucked into every crevice of the car, but the Myxomycete harvest was not. In a last attempt to find some small sample from the highlands, we stopped by a rocky stream that had a few green trees along its bank. Under the shelter of enormous boulders, there were a few branches encrusted with lichens and even a mossy bank. All were desiccated. A high altitude, dry land, brown-shelled crab moved slowly across the ground. My eyes turned back to the moss and at last spied a few poor specimens of the little fungi.

As before, the trip through the rain forest was an opportunity to store memories of a type of vegetation I might never see again. As soon as the realization came that the marvelous excursion was drawing to a close, the recollection of the necessity of passing through Quevedo returned. We had not discussed it among ourselves, and the moment arrived. Once more the car stopped. Once more we were ordered out. Once more an object was brought from the interior and the inquisition began. This time it was not ammunition. It was a book — a paper-bound edition of Irving Stone's "The Agony and the Ecstasy" with the letters of the title emblazoned across the cover in bright, bold colors. The soldiers thought it might be a foreign propaganda pamphlet. Explanations were received, and off we went. The gun was not sought, not found.

The Departure

Farewells in Ecuador, as in other Latin countries, are as ceremonial as welcomes. These procedures, in contrast to the earlier ones, were not anticipated with fearfulness, but with sorrow. I had experienced great kindness, affection, and hard worthwhile work. Fondness for a people had changed to understanding of friends, and understanding of friends in turn to their appreciation of our efforts. Of all the letters I have received, the one that seems best to epitomize the warmth of the Ecuadoreans for the United States was from Dean Quiroz, written November 25, 1963: "I must tell you how sorry we are for the dead of President Kennedy, everybody was very surprised with the bad news and at the beginning we did not believe that such a thing could happen. We knew the notice one hour after Kennedy died, everybody stop working and the whole afternoon were talking about. Now many buildings show the flags half way and many Institutions express the condolence by the press. My wife and I think very much for his wife and the children, it is really something very hard to explain in any language."

A New Hybrid Stewartia

Hui-Lin Li

A new hybrid *Stewartia,* arisen spontaneously in cultivation, is herein described. The putative parents are *Stewartia koreana* Rehder of Korea and *S. monadelpha* Sieb. & Zucc. of Japan. The hybrid is named after Mrs. J. Norman Henry, of Gladwyne, Pennsylvania, in whose garden it originated.

The hybrid shows certain characteristics of either parent species and others that are intermediate between the two. It is reasonably certain that *S. koreana* is the female parent, as seedlings of this hybrid are found only under a tree of this species while *S. monadelpha* is some distance away. The seedlings are vigorous healthy growers much more floriferous than either parent. The white flowers are much larger than those of *S. monadelpha* but somewhat smaller than those of *S. koreana,* although the very numerous flowers produced, which are more or less evenly distributed on the branches over the entire crown of the trees, present a far more showy appearance than *S. koreana*. One tree is especially floriferous and well shaped, and this is being selected for preservation and propagation. As this is a highly ornamental plant of great horticultural promise, it seems desirable to give this new hybrid a name for its identity. (Fig. 23)

Stewartia × **Henryae,** hybr. nov. (Hybrid inter *S. koreana* Rehder et *S. monadelpha* Sieb. & Zucc.). Arbor parva, ramulis pilosis; foliis oblongo-ellipticis, 6-7 cm. longis, 2.5-3.5 cm. latis, subtus pubescentibus, basi cuneatis, apice abrupte acuminatis, margine remote serrulatis; floribus axillaribus, pedicellis 1-1.5 cm. longis, bracteis 2, orbicularibus, circiter 0.7-1 cm. longis, quam sepalis aequantibus, petalis 5, late obovatis, circiter 2-3 cm. longis et latis.

Fig. 23. *Stewartia* × *Henryae*

Fig. 24. Type specimen of *Stewartia* × *Henryae*

This is a small tree which grows to an height of 10 m. or possibly more. The branchlets are pilose, mostly zigzag and slightly compressed. The winter buds are ovoid, compressed and pointed, 6-7 mm. long and with about 4 imbricate silky scales. The elliptic to oblong-elliptic leaves measure about 6-7 cm. long and 2.5-3.5 cm. broad, cuneate at the base, abruptly acuminate at the apex, and remotely and more or less inconspicuously serrulate at the margins. They are pubescent beneath. The pure white flowers are 4.5-6.5 cm. across. They are borne on axillary pedicels 1-1.5 cm. long, and with 2 bracts about 0.7-1 cm. long or about as long as the sepals. There are 5 sepals, suborbicular in shape, about 7-10 mm. long, and densely pubescent. The 5 white petals are broadly obovate, about 2-3 cm. long and broad. The outer ones are slightly concave and the innermost nearly flat. The capsule is ovoid, rostrate, about 1.5 cm. long and appressedly pubescent on the outside. The dark brown seeds are few, compressed and winged and variable in size from 3 to 6 mm. in length.

TYPE, in Herbarium of the Morris Arboretum, collected by H. L. Li, June 9, 1963 (flower) and January 12, 1964 (fruit), from a plant in cultivation at Gladwyne, Pennsylvania. (Fig. 24)

In leaf-size, flower-size, length of pedicels, and fruit-size, the hybrid is intermediate between the smaller-leaved and small-flowered *S. monadelpha* and the larger-leaved and much larger-flowered *S. koreana*. The branchlets are pilose as in *S. monadelpha*, but the leaf-shape, especially in the apex, approaches more *S. koreana*. Subtending the flowers, *S. monadelpha* has characteristically two conspicuous bracts which are larger and longer than the sepals, while *S. koreana* has 4-5 rather inconspicuous ones which are smaller than the sepals. In the hybrid, there are also two bracts as in *S. monadelpha,* but these are relatively smaller and only about as long as the sepals. Altogether, the hybrid nature of this plant seems to be quite clearly indicated.

To summarize, a comparison of some of the characters of the three taxa involved is given as follows:

	S. monadelpha	*S. × Henryae*	*S. koreana*
Branchlets	pilose	pilose	glabrous
Leaves - length	4–6 cm.	6–7 cm.	6–10 cm.
Leaves - apex	acute to acuminate	abruptly acuminate	abruptly acuminate
Flower-size	2.0–3.5 cm. across	4.5–6.5 cm. across	7–7.5 cm. across
Pedicels - length	0.6–1.5 cm.	1–1.5 cm.	1.5–2.5 cm.
Bracts - number	2	2	4–5
Bracts - length	longer than sepals	as long as sepals	¼ as long as sepals
Capsule - length	1 cm.	1.5 cm.	2 cm.

The Second Barnes Lecture

The second in the series of Laura L. Barnes Lectures in Botany and Horticulture will be given at 8:00 P.M. on Wednesday, April 15, in the auditorium of the Springside Senior School at Willow Grove Avenue and Cherokee Streets in Chestnut Hill. The lecturer will be Dr. Richard A. Howard, Director of the Arnold Arboretum, who will speak on "Botanical Impressions of the African Continent." Dr. Howard's talk will be illustrated with kodachrome pictures taken by him on the occasion of a recent trip to this fascinating area which supports so many unique plants.

Many of our readers will recall that this lectureship was established in honor of Dr. Laura L. Barnes, Director of the Arboretum of the Barnes Foundation in Merion, Pa. The first lecture in the series was given in April 1963, by Dr. John S. L. Gilmour, Director of the Botanic Garden at Cambridge, England.

Associates of the Arboretum and their friends are cordially invited to attend Dr. Howard's lecture.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since December 1963:

Mr. M. L. Breiden
Mr. Edward Davis
Mrs. G. W. Jackson
Mrs. James Kenney, Jr.
Mrs. Henry Klaber
Mrs. Charles E. McAleer
Mrs. Elmer C. Rowley
Mrs. Barry Jay Schwartz
Mr. & Mrs. Lancelot F. Sims
Mrs. Katherine C. Wharton

Galega Officinalis: A Weed New to The Arboretum

John M. Fogg, Jr.

On July 9, 1963, I collected a low-growing, white-flowered leguminous plant in the north meadow at the Morris Arboretum. In its terminal inflorescences and pinnately compound leaves it somewhat resembled an *Astragalus,* but closer examination revealed that it was not a member of that genus. It was also apparent that no mention of the species was to be found in Gray's Manual (1950), the New Britton and Brown "Illustrated Flora" (1952) or any of our other eastern manuals or floras.

Since I was busily engaged at the time in teaching a summer school course, I turned my material over to my colleague, Dr. E. T. Wherry, asking him to see whether he could match it with anything in the herbaria at the University of Pennsylvania or the Philadelphia Academy of Natural Sciences. Dr. Wherry later suggested that the plant bore a strong resemblance to the Eurasian *Galega officinalis* L., but pointed out that flowers of that species are bluish-purple, rather than white, and emphasized the necessity of having fruiting material for satisfactory identification.

I therefore collected the plant again on July 23, at which time it was in mature fruit. Its smooth, linear, torulose or constricted pods were strongly reminiscent of something I had seen before and, on checking our records, I discovered that Dr. Wherry, Dr. H. A. Wahl of Pennsylvania State University, and I had collected this same species along a dry roadside, one half mile south of Farmers Valley in McKean County, Pennsylvania, on August 16, 1950. The plant, which had baffled us at that time, was later identified as *Galega officinalis* by Mr. Bayard Long, of the Philadelphia Academy of Natural Sciences.

Since our McKean County material had also been in fruiting condition, the question of flower color had not occurred to us. I therefore sent a specimen of my first collection from the Arboretum to Dr. Harold E. Moore, Director of the Bailey Hortorium at Cornell University, Ithaca, New York. In a letter to me dated August 1, Dr. Moore said that the plant had been identified by Dr. George Bunting of his staff as *Galega officinalis.* He added that, "Since Dr. Bunting has been working on the cultivated legumes he has had an opportunity to note that this species includes a number of color forms." It turns out that our white flowered material has already been designated as var. *albiflora.*

Galega officinalis, or goat's rue as it is commonly called, is native to central and southern Europe and western Asia. It is an upright perennial plant with 11 to 17 leaflets and axillary or terminal racemes of bluish, purplish, (rarely white) rather large, papilionaceous flowers. It has for many years been cultivated in European and American gardens, although in this country it is apparently less popular than was the case during the 19th century. Nevertheless, it is still mentioned in Bailey's Cyclopedia (1915), Hortus II (1941) and such recent works as Bush-Brown's Garden Book (1958) and Taylor's Encyclopedia of Gardening (1961).

Desirous of learning to what extent this Old World species has escaped from cultivation in this country, I addressed inquiries to four of our leading botanical institutions and have obtained the following information.

Dr. Richard A. Howard, Director of the Arnold Arboretum reports that in the Harvard University Herbarium there are specimens of this plant from the following localities:

Cornell Campus, Ithaca, N.Y., 1928
Fairfield Co., Conn., 1921
Inghahm Co., Mich., 1902 (in experiment station plots)
Logan, Utah, 1902 and 1932
Golden Gate Park, San Francisco, California (no date)

Mrs. Mark F. Emerson, with the assistance of Mr. Frank C. MacKeever, examined the material at the New York Botanical Garden and reported the following collections from the herbarium of that institution:

In cultivation, New York Botanical Garden, Bronx Park, N.Y., 1929
Logan, Utah, 1895 and 1920
Grass flats, Colorado, 1890

From the U. S. National Museum in the Smithsonian Institution in Washington, D.C., Dr. Velva E. Rudd, Associate Curator of the Division of Phanerogams, has kindly provided the following information:

Cambridge, Mass., 1919
In grass garden, Washington, D.C., 1897 and 1898
Garden City, Kansas (cultivated), 1890

Dr. Rudd adds the comment, "I am surprised to find so little material from a species that could very well escape from cultivation. Apparently goats-rue has lost favor as a garden flower."

Fig. 25. *Galeopsis officinalis*

Finally, Dr. Hugh C. Cutler, of the Missouri Botanical Garden in St. Louis, had this to record:

> Utah State College Campus, Utah, 1938
> U.S.A.C. Experiment Farm, 3 mi. north of campus, Cache Co., Utah, 1932 plus two collections from Argentina.

Probably a wider canvass of eastern American herbaria would have yielded a few additional stations for the occurrence of this species, but it is not likely that they would have added materially to our understanding of its behavior.

Although, as noted earlier, this plant has been found at several localities in the eastern United States, it does not seem to have found its way into any of our eastern regional manuals or local check-lists. However, Rydberg (1932) includes it in his Flora of the Prairies and Plains, with the statement, "Escaped from cultivation: Utah-Kans."

The first colony of *Galega* which I noticed at the Arboretum was located in low wet ground along a small stream in the meadow just south of Northwestern Avenue. Later I observed a much more extensive stand of it on the border of a roadside ditch along Stenton Avenue, a short distance above Erdenheim Road (Fig. 25). Both stations are on the grounds of the Morris Arboretum, in Chestnut Hill, Philadelphia County, Pennsylvania. Specimens of one or the other of my two collections, Fogg 22270 or 22271 are deposited at the Bailey Hortorium, Ithaca, New York, the herbarium of the University of Pennsylvania and the herbarium of the Morris Arboretum. (Fig. 26)

Fig. 26. Herbarium sheet of *Galega officinalis*

Since both of the localities where this species was observed are under almost constant scrutiny during the summer months, it seems reasonable to assume that the plant made its first appearance here during the season of 1963. It gives every appearance of being firmly established and capable of spreading. We shall keep it under observation and be prepared to report on its future performance.

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Arboretum Activities

(*Continued from Page 2*)

Dr. Li is continuing his studies on the flora of Taiwan and is now devoting his attention to detailed examination of certain groups of herbaceous plants on that island.

Dr. Allison was the speaker at the regular meeting of the Philadelphia Botanical Club on January 23. Her topic was "From Sea Level to the Sierras in Ecuador." An account of her experiences in teaching a course in Mycology at the University of Guayaquil appears in this issue of our Bulletin.

Mr. Dourley represented the Arboretum at the meetings of the Eastern Pennsylvania Nurserymen's Conference held at the Presidential Apartments on January 9th.

Mr. Fenninger Honored

It is our happy privilege to inform those few who may not be aware of it, that at its Spring Luncheon on March 10 the Pennsylvania Horticultural Society bestowed its award for distinguished service to Horticulture upon Mr. Carl W. Fenninger.

The citation which was read on this occasion stressed, among other things, Mr. Fenninger's contributions to the Tyler Arboretum, The American Horticultural Society, The American Association of Botanical Gardens and Arboretums and the Germantown Horticultural Society

Mr. Fenninger is an Associate and a member of the Advisory Council of the Morris Arboretum.

The Heath Garden

Our issue for September, 1963 (Vol. 14, No. 3) contained a brief account of the new Heath Garden which has been established on the South Slope, not far from the Baxter Memorial. As the setting out of plants in this garden progressed, it became evident that we needed a considerably larger site than had originally been allotted. Consequently, this winter has witnessed a doubling of the area. This has required preparation of the soil, contouring of the slope and placing of boulders to provide a background for an extensive collection of heathers which will be outplanted this spring.

19th American Horticultural Congress

The nineteenth American Horticultural Congress will be held in New York from September 30 to October 3, 1964, with headquarters at the Hotel Commodore.

This promises to be a memorable event with tours, exhibits and a special A.H.S. day at the New York World's Fair. Information concerning events of special interest to our readers will be announced in future numbers of this Bulletin.

European Tour

In connection with the International Horticultural Exhibition to be held this year in Vienna, Dr. & Mrs. Fogg will conduct a three week's tour to Europe, from May 7 to May 28. In addition to visiting the Vienna Exhibition, the party will spend several days in Munich, seeing the famous botanical garden there and taking a side trip to Berchtesgarden and Salzburg.

Five days will be spent in Holland with headquarters in Amsterdam and trips to such renowned horticultural and botanical centers as Utrecht, Wageningen, Leyden and Boskoop.

By bus the party will then travel to Brussels and will spend about a week in Belgium, visiting Ghent, Bruge, Antwerp, Kalmthout, the Tervuren Arboretum and the new National Botanical Garden.

A final two or three days will be spent in Paris before returning to Philadelphia by regularly scheduled jet flight. Total cost, approximately $835.

At the time of this writing there is still space for a few members of the party. Anyone interested should either write or telephone the Arboretum.

Plant Distribution

The annual distribution of plants to our Associates will take place on Friday, May 22, and Saturday, May 23. Prior to this date notices will be mailed to all Associates. J. M. F., Jr.

Associates' Corner

A Two-dimensional Botanical Garden

To many persons the idea of a pressed and dried plant is somewhat repugnant. An assemblage of such specimens (known as an herbarium) has been referred to by someone as, "just so many mummies." Yet it is fair to state that without such collections our knowledge of the plants of the world would be only a fraction of what it is today.

During the great age of exploration in the 1700's many living plants were sent from all over the earth to the gardens of western Europe. Many more, however, were received as pressed and dried specimens for study by the trained botanist. Most of the plants of eastern North America were first described from herbarium material sent to authorities like Linnaeus and Gronovius who never set foot in the New World.

After all, there is a good deal of difference be-

tween a bunch of violets flattened in the family Bible and a carefully prepared, pressed, dried and mounted herbarium specimen. The latter should show the plant in all of its parts, should retain most if not all of its original color and may last for many years. One of the oldest collections of dried specimens in the world was made by an Italian herbalist in the 16th century and may still be seen in Florence.

The botanist trained to study herbarium material soon learns to visualize the specimen as a three-dimensional living thing. For him it is superior to that other two-dimensional subject, a picture, for it retains the texture of the foliage and the flowers and is, of course, "life size". An explorer can spend precious daylight hours collecting and pressing plants in the field with the satisfaction of knowing that his "catch" can be studied at leisure during the dormant season or during the long winter months back home.

All of this is merely preparatory to saying that the Morris Arboretum, like most others, has its own herbarium. Although a mere 40,000 specimens, the actual sheets are works of art, beautifully mounted, and cover a wide geographic area — from the arctic to the equator, as a matter of fact. The herbarium is situated in a bright, sunny room on the second floor of the Gates Building and is furnished with broad working tables between the cases.

The plants are filed according to families, genera, and species, and then further arranged by states and finally counties. Many specimens have an envelope attached in which extra parts for microscopic study are kept.

Since an aboretum is primarily concerned with growing woody plants, most of the specimens in our herbarium were collected from trees, shrubs and vines. There are, however, some herbaceous (soft-stemmed) specimens, but these are all of horticultural origin and there is a good reason for this. When someone sends in a lily or a phlox to be identified it's a big help to have a correctly named herbarium specimen with which to compare it.

In addition to performing a reference function for the staff of the Arboretum, specimens are frequently borrowed for study by specialists at other institutions.

The nucleus of our herbarium has been the Arboretum's own collection of over 3000 kinds of living plants. A concerted effort has been made to collect every one of these species in its winter condition, in flower, in foliage, and in fruit, for only in this manner can one appreciate the plant's seasonal development. Such a collection is not only invaluable as a reference set, but it provides the answers to such questions as "When can I expect my Chinese dogwood to flower?", or "How variable are the leaves of sassafras?". Most of the credit for this collection belongs to Mr. Joseph W. Adams, whom Dr. Fogg engaged in 1932 to start building up the herbarium.

By exchange with other institutions, and occasionally by purchase, the Arboretum has acquired a vast amount of material from all over the world. There is, for example, a very full representation of plants collected in the Arnold Arboretum of Harvard University. There are also specimens from the New York Botanical Garden, the Missouri Botanical Garden and other important centers. Members of the staff have greatly enriched the collection by their own field-work. Dr. Li's wonderful book on the woody plants of Taiwan was reviewed in the September issue of this Bulletin. Many of the descriptions in that work are based upon the fine collection of Formosan plants housed in the Arboretum herbarium which have been filed in blue covers for ready identification. Dr. Fogg's trips to southern Asia and to the American tropics have resulted in the addition of many specimens which are potentially significant either in horticulture or in medicine. The collection of *Rauwolfia,* the source of most tranquilizers, is probably the richest in the United States.

Some years ago the Arboretum purchased a set of the plants collected by the late J. F. Rock on his historic expedition to Southwestern China. This series is extremely rich in rhododendrons, viburnums and many other groups of horticultural value. Another large and important collection is the Elmer series of Philippine plants.

Since all species of cultivated plants exist, or have at one time existed, in the wild state, it is desirable that the collection of the Arboretum's own living specimens be supplemented by material found in nature. So, for example, in the folder which contains sheets of the swamp bay (*Magnolia virginiana*) growing on the Arboretum grounds, there will be found mounted specimens of the same species all the way from New Jersey to Florida. This permits a comparison of its variations throughout its natural range as well as in cultivation.

In this article we have spoken of the herbarium as a whole, at a later date we will tell of the fascinating collection of fruits. People flock to art museums to view the pictures and sculpture. Here in our own vicinity with no parking problem, are works of art equally beautiful to gaze upon whether you have a knowledge of Botany or not. The next time you visit the Arboretum ask someone to show you this two-dimensional botanical garden. I am sure that it will be as much of a revelation to you as it was to me.

MARION W. RIVINUS

EDITOR'S NOTE: Photographs of two specimens from the Arboretum herbarium appear elsewhere in this issue. (Figs. 24 and 26) .

Morris Arboretum Bulletin

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Picea Omorika at Nymphenburg Garden

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THE ASSOCIATES, through whose interest and generosity *The Bulletin* and certain other undertakings of the Arboretum are made possible, is an informal group of individuals interested in encouraging and furthering the educational and research endeavors of the Morris Arboretum.

CLASSES OF MEMBERSHIP

Contributing	$ 5.00 a year	Supporting	$ 25.00 a year
Sustaining	$10.00 a year	Sponsoring	$100.00 a year
		Donor	$500.00

Arboretum Activities

THE STAFF

On March 17 the Director presented an illustrated lecture on "New or Unusual Trees", before the Garden Club of Philadelphia and on March 26 he gave a talk entitled, "A Look at Some of our National Parks", to the Philadelphia Botanical Club. At a meeting of the Radnor Historical Society on March 31 he spoke on, "Historical Arboretums of the Philadelphia Area" and before the Community Garden Club of Wayne, Pa., on April 2, he offered an illustrated discussion of "Plants and Environment." On April 10 he appeared on the program of the annual meeting of the American Holly Society which was held at Longwood Gardens; his topic was, "The Hollies of the Morris Arboretum." At the Third Annual Clara B. Ford Garden Forum conducted at the Henry Ford Museum, Dearborn, Michigan, Dr. Fogg gave a lecture entitled, "A Twentieth Century Medicinal Garden." On April 25 he addressed the Friends of Tinicum Marsh on "The Relationship between Plants and Birds in the Tinicum Marsh Area."

(Continued on Page 31)

The Morris Arboretum European Tour

John M. Fogg, Jr.

On May 7 a party consisting of some 30 persons left New York by regularly scheduled jet flight for a three weeks' tour of western Europe which had as its primary objective the International Horticultural Exhibition held this year in Vienna. The Director of the Morris Arboretum and his wife functioned as Tour Directors. The group was made up largely of Associates of the Morris Arboretum and present and former students of the School of the Arboretum of the Barnes Foundation at Merion. It was our very good fortune to have Dr. Laura L. Barnes, the Director of that Arboretum, as a member of our tour.

Our first day in Vienna was overcast with occasional showers, one of only two or three such days during the entire three weeks of our stay in Europe. It was devoted to a visit to Schönbrunn Palace, with its more than 1400 rooms, in the morning and the world-famous Vienna Woods in the afternoon.

Fig. 28. Tulips at the Vienna Exhibition

On Sunday, May 10, the group spent the day at the International Horticultural Exhibition which occupies an area of about 250 acres in a former aquatic sportsground between two arms of the Danube, 2½ miles north of the center of the city.

Fig. 27. Tower at the Vienna Exhibition

The exposition grounds have as their focal point an 820-foot high tower (called the Donauturm), with a restaurant near the top, which affords a superb view of the show and of the city of Vienna and its environs (Fig. 27). There are also a chair lift and a miniature railway which give the visitors a panoramic view of this monumental display, reputed to be the largest international horticultural exhibit ever staged. Obviously, however, for the botanically minded the only way to appreciate such a exhibition is to walk through it in a leisurely manner and this our party did.

Because of the magnitude and the diversity of this monumental layout, it is impossible to convey more than a superficial impression of its essential nature. For more than an hour we strolled through a mixed planting of shrubs and herbaceous perennials. The latter was particularly rich in alpine material, with emphasis on such genera as *Saxifraga, Arabis, Statice, Gentiana, Papaver, Potentilla,* etc.

Fig. 29. Greenhouses in the Schönbrunn Garden

Among other outstanding features are a rock garden, a superb collection of *Iris,* a fine display of rhododendrons and azaleas, a medicinal garden (known as the Paracelsus garden) a rose garden and an extensive section devoted to the Gardens of the Nations. With respect to the last-named, it is distressing to be forced to report that the United States entry is far and away the least impressive.

To many visitors, no doubt, the most spectacular display of the entire show was the section devoted to tulips. Here in an area covering many acres were millions of tulips at the very height of their bloom, representing several hundreds of individual species, hybrids and named forms. It is difficult to imagine a more magnificent panorama of brilliantly massed colors. (Fig. 28).

All in all, the 1964 International Horticultural Exhibition at Vienna must be regarded as a highly successful show, one which may well serve as a model for future events of this kind.

Schonbrunn Gardens

By a happy circumstance our Park Hotel in Vienna stood on the very edge of the vast park which adjoins Schönbrunn Palace. Although largely devoted to many acres of formal plantings, with fountains and statues, the portion of this park closest to our hotel is a botanical garden with majestic trees, most of them labeled, and spectacularly attractive beds of herbaceous material. It was interesting to observe fine hedges composed of such ubiquitous European tree species as beech (*Fagus sylvatica*), hornbeam (*Carpinus Betulus*), and maple (*Acer campestre*), and to see plane trees (*Platanus* × *acerifolia*) and lindens (*Tilia* spp.) beautifully espaliered. The greenhouses in this garden are well worth visiting and in between sight-seeing trips the members of our party might be found wandering through the various sections, rich in tropical and economic plants. (Fig. 29). Of particular note was an area devoted to such insectivorous genera as *Sarracenia, Darlingtonia, Nepenthes, Pinguicula* and *Drosera.*

To be in Vienna at horse-chestnut time is in itself a rare experience. In almost every park and garden and along many of the boulevards these stately trees, both the white and red forms, were in full flower, imparting a festive air to this fine old Austrian capital.

Munich

From Vienna, at mid-day, the party flew to Munich, the capital of Bavaria, where the afternoon was devoted to sightseeing. The following day, May 12, was spent at the famous Nymphenburg Garden, generally regarded as the finest botanical garden on the continent of Europe. Our host and guide here was the Curator, Dr. H. Christian Friedrich, eminent authority on the flora of South Africa and specialist on the difficult family Aizoaceae. Thanks to his intimate knowledge of the grounds and greenhouses, we were able to take fullest advantage of our day at Nymphenburg.

The morning hours were devoted mostly to inspecting the Schmuckhof or Ornamental Gardens, with their superb display of herbaceous material (Fig. 30) and the rock garden which is certainly one of the best of its kind in the world. Here the high altitude plants of many countries are arranged in geographical order, so that one may study the alpine floras of Scandinavia, the Central Alps (Fig. 31), the Pyrenees, the Carpathians, the Balkans, Asia Minor, the Caucasus, North America, etc.

Fig. 30. Ornamental Gardens at Nymphenburg

Fig. 31. Central Alpine section in Rock Garden at Nymphenburg

Also in this general area are fine representations of low and high heath, moor and bog vegetation as well as a distinguished arboretum with magnificent mature specimens of conifers and deciduous trees. (See Cover).

Following lunch at a delightful restaurant in the woods where we drank Mai Bock and partook of Bavarian food, we returned to the Garden to inspect the greenhouses which in my experience are equaled, as far as Europe is concerned, only by the newly constructed ones at Meise, Belgium. Here are splendid collections of tropical and sub-tropical plants, superb representations of cycads, palms, aroids, gesneriads (especially *Columnea*) and houses for cacti and succulents which according to my wife are simply "out of this world". (Fig. 32). Toward the end of this busy and fascinating day we inspected the medicinal garden and the systematic beds, where plants are arranged according to the Engler-Prantl system of classification.

Leaving Munich on May 13, the party traveled by bus to Salzburg. Our way led at first through pleasant farmland, then through fine stands of Scots' pine (*Pinus sylvestris*) and Norway spruce (*Picea Abies*) and finally into the heart of the Bavarian Alps with their jagged snow-capped peaks. A brief stop was made at Garmisch-Partenkirchen and a longer one (for lunch) in the incomparably quaint city of Innsbruck. Salzburg, on the banks of the Salzach River, and nestled at the foot of majestic mountains, was reached in late afternoon.

The next day was largely one of sight-seeing, although the gardens and fountains of Hellbrunn Palace provided both interest and enjoyment. Back in Munich the following day, we emplaned in late afternoon for Amsterdam which was to be our base of operations for the next five days.

Netherlands

One of the most interesting small gardens in Europe is the Hortus Botanicus of the Hugo de Vries Laboratory in Amsterdam. Like most gardens which date from the early 1700's, this was originally a collection of medicinal plants affiliated with a university. Today it boasts many fine old tree specimens, a systematic section, an aquatic garden and a splendid series of greenhouses. Dr. A. D. J. Meeuse, the Director, very kindly received us and gave us a great deal of interesting information concerning the history of this garden and its collections.

To many people Holland means tulips and tulips mean Keukenhof. It was our great good fortune that, due to cool weather, Keukenhof's Festival of Spring at Lisse was still open and we spent an exciting afternoon there on May 17. In a beautiful area of woods, water and parkland covering some 60 acres there is spread out an incredible display of brilliant color (Fig. 33). While we were too late for squills, hyacinths, narcissus and early tulips, the late-blooming tulips were at their height, both in the field and in the greenhouses, and two hours was all too short a time for enjoying the seemingly limitless diversity in form and color of these ever popular plants.

On May 18 the party journeyed to Baarn, the country seat of the Government, where our bus was met by Dr. Frans A. Stafleu, Professor of Botany at the State University of Utrecht. Dr. Stafleu conducted us to the nearby Cantonspark Garden which is affiliated with the University and is used in the teaching of botany. Although not large, this is a tremendously interesting garden with sections devoted to rock plants, geographic origin and systematic arrangement.

Fig. 32. A section of the Cactus House at Nymphenburg

Fig. 33. A section of the tulip display at Keukenhof

In the beds devoted to North America one of the most impressive plants was the western skunk cabbage, *Lysichiton americanum*. A series of half a dozen greenhouses contains an excellent representation of tropical and warm temperate material.

From Baarn we drove to Wageningen, the national center for horticultural and agricultural research. After luncheon at the Wageningse Berg Hotel, overlooking the Rhine, we were welcomed by Dr. H. J. Venema, the Director of the Belmonte Arboretum. Dr. Venema and his Curator, Mr. W. J. M. Janssen, spent the afternoon showing us around the new aboretum with its rich collections of *Sorbus* (more than 100 species and varieties), *Lonicera, Viburnum, Quercus, Prunus, Rhododendron* and many other woody genera.

May 19 was largely devoted to sight-seeing, with a tour by bus to Haarlem, Leiden, Delft and The Hague. We did, however, catch a glimpse of the very famous Botanical Garden at the University of Leiden. This garden is a reconstruction of the Hortus Botanicus of Charles de l'Écluse (Clusius), a sixteenth century herbalist.

Fig. 34. "Field of Tulips" at Madurodam

Much has been written about Madurodam, the miniature "city" on the outskirts of The Hague. Here, with everything at a scale of one-twenty-fifth natural size, is a complete cross-section of the history of the Netherlands from ancient thatched cottages to towering apartment houses, a modern harbor and an airport. Of considerable interest to members of our party was the skillful use of dwarf plant material to preserve the illusion of natural plantings around these tiny buildings. Particularly intriguing were a representation of a coniferous forest and a plantation of tulips. (Fig. 34).

Thanks to a prodigiously early start on Wednesday, May 20, we succeeded in reaching Aalsmeer while the flower auction was still in progress. Here, in two enormous sheds, millions of cut flowers are bought and sold every day to be shipped to many parts of the world. It is a sight never to be forgotten.

Fig. 35. Typical nursery at Boskoop

Later in the morning our bus stopped at Boskoop, the nursery center of the Netherlands. More than 600 nurseries are located in this region and many of them bear world-famous names such as Koster, Van Nes, den Ouden, Grootendorst, etc. A view across one of these nurseries is here shown. (Fig. 35).

Also located at Boskoop is a School of Horticulture and an extensive experimental garden or series of trial beds. This was especially rich in cultivars of *Syringa, Prunus, Cytisus, Rosa, Paeonia,* etc. After stopping for lunch at Rotterdam (the seat of the 1962 International Horticultural Exhibition) we crossed the border into Belgium and arrived in Brussels, our headquarters for the next four or five days.

Fig. 36. General view of Kalmthout Arboretum

Belgium

The following day, May 21, was devoted to a sightseeing tour of Bruges and Ghent, with their marvelous examples of mediaeval architecture. However, on the way back from Ghent we stopped at Melle to inspect a famous azalea nursery and the superb gardens and greenhouses of the National Horticultural School. In a sense, Melle is to Belgium what Boskoop is to the Netherlands and visits to these great nursery centers makes one appreciate what a tremendous role horticulture occupies in the economy of these two countries.

Kalmthout Arboretum

Friday, May 22, must, on many counts, be rated as the high spot of our entire trip for it was on this date that we visited the Arboretum at Kalmthout, a few miles north of Brussels. This arboretum, which was established in 1856 by the Antwerp nurseryman, Charles van Geert, is owned today by Mr. and Mrs. Robert de Belder who have developed it into one of the finest and most discriminating collections of woody plants to be found in Europe. Here are more than 700 species and botanical varieties of roses, one of the finest assemblages of *Acer, Quercus, Hamamelis, Prunus, Magnolia, Stewartia* and *Rhododendron* imaginable, a superb representation of conifers and a nursery replete with so many thousands of seedlings that one can only wonder where on these spacious yet crowded acres they will find a home.

Fig. 37. *Picea Omorika* at Tervuren

Enough, although far too little, about the Arboretum; now a few words, also far from adequate, about our charming host and hostess. Mr. de Belder had traveled by train to Antwerp to meet our bus and guide it to Kalmthout. As we disembarked Mrs. de Belder appeared to greet us and to offer us a refreshing fruit drink before starting off on an hour's tour of the grounds. (Fig. 36). Upon returning from this walk we were served a seemingly limitless variety of hors d'oeuvres on the lawn before entering the house (itself a museum piece) to be served a luncheon which one of our party described as nothing short of "cordon bleu." Following this repast we took off for another section of the grounds and before our departure for Brussels we were served a round of delicious iced coffee with many sorts of cakes. It may be taken for granted that whenever and wherever members of our party assemble in the future a toast will be offered to the incomparable hospitality of our gracious host and hostess at Kalmthout.

Fig. 38. View in the Jardin Botanique de Meise

The following day we had another fascinating experience when we visited the Geographic Arboretum at Tervuren, situated just a few miles from Brussels. Here we were received by the Director, Dr. U. G. Liénard and his uniformed

staff who led us on a tour around this 260 acre enclosure where practically every species of tree hardy in temperate areas is grown in its own designated geographic grouping. Since this remarkable Arboretum, which was established in 1902, was described in some detail in a previous issue of this Bulletin,[1] I shall not dwell further upon it here. Suffice it to say that there is probably no other arboretum in the world where one can walk through mature forest plantings of practically every wooded area of the northern hemisphere from Alaska across North America and Eurasia to the Japanese Archipelago. (Fig. 37).

Brussels boasts two botanical gardens, one old and the other very new. The former is in the central city area and although small is well worth a visit, particularly because of its happy blending of shrubby and herbaceous material. Well grown poppies and lupines are artfully planted among interesting species of *Cotoneaster, Hebe, Hydrangea* and *Cytisus*. The result is a fine show of color against an attractive background.

[1] Fogg, J. M. Jr., Morris Arboretum Bulletin. Vol. 13: 60-62. 1962.

The newly established Jardin Botanique de Meise is located a few miles outside the city. It occupies a beautiful old estate with majestic trees, (Fig. 38) a fine lake and a mediaeval chateau. The new greenhouse system, erected in 1957-58, is certainly among the most extensive to be found anywhere in Europe. Although perhaps not as attractively planted as the greenhouses at Munich, it contains an amazing wealth of unusual plant material.

The final days (May 25 to 28) of our trip were spent in Paris where the emphasis was on sightseeing and shopping. However, some of us spent an afternoon at the renowned Jardin des Plantes which was established in 1635. Here are formal beds in systematic sequence, fine old trees, e.g. a Corsican Pine (*Pinus nigra* var. *Poiretiana*) planted by A. de Jussieu in 1774, and an excellent alpine garden.

In retrospect, the Morris Arboretum Tour may be viewed as a varied experience which furnished an introduction to some of the best known botanical gardens in western Europe as well as some of its finest scenery and most famous monuments.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since March, 1964:

Mrs. L. Talbot Adamson
Mr. Frederick E. Aubel, 3rd
Mrs. Lindley M. Cowperthwait
Mrs. David D. Heath
Mrs. Elizabeth Herkness
Mr. and Mrs. Harry Hewitt
Dr. Laurent B. Houle
Mrs. Albert M. Hoyt, Jr.
Mrs. Charles M. James
Mrs. Kathryn B. Lamond
Mr. J. L. Landenberger
Mrs. Daniel M. Layman
Mrs. Morris Lloyd, Jr.
Miss Elizabeth Maderia
Mr. Joseph Missimer
Mrs. Wm. F. Newbold
Mr. Charles Reichner, Jr.
Mr. and Mrs. John V. Reilly
Miss Karen M. Rondum
Mrs. William A. Schnader
Mr. F. G. Tatnall
Mrs. John R. Young

An Appreciation of Magnolia Campbellii Subspecies Mollicomata

D. Todd Gresham

In a very informative paper by Dr. E. K. Janaki-Ammal, in the Indian Journal of Genetics and Plant Breeding, new respect for the antiquity of the Magnoliaceae is developed.

We are told that flowering plants as we know them made their appearance 140 million years ago, fossils from that age proving them to be as fully developed then as they are today.

The oldest flowering plant, indicated by fossil remains, is *Magnolia pterocarpa*. Stranger still, this same species is found growing today in Assam and Burma, in its primitive form, a living fossil.

Then, as now, nature gave the various forms of flora and fauna three alternatives in the grim struggle for survival. 1. Remain passive in position, and if conditions were not favorable for growth and reproduction, be eliminated. 2. Retreat to locations favorable for survival. 3. Stand and fight by adjusting to conform with existing conditions.

Fig. 39. *Magnolia* 'Maharajah'

Fig. 40. *Magnolia* 'Maharajah'

All present day species of *Magnolia* chose to cope with either Condition 2 or Condition 3, in their effort to maintain themselves in locations favorable to reproduction and perpetuation. The successful species conducted a two-pronged retreat, establishing themselves along one prong from southeastern Ontario, the southeastern United States, Cuba, Mexico, to Central and South America. The other prong speared into Eastern Asia, with foot-holds in China, Burma, Japan and Java.

Basically all ancient species of *Magnolia* were diploids, (2n = 38). The ancestors of today's diploid *Magnolia* undoubtedly chose Condition 2 to insure survival; their descendants remain diploids.

It has always been easier to retreat than stand and fight, but the heat of battle usually alchemized the warriors into something very special. This is true of the Magnolia illustrated: *M.*

Fig. 41. *Magnolia* 'Maharajah'

Campbellii subspecies *mollicomata,* a member of the Section Yulania, beyond doubt the most coveted and beautiful section of *Magnolia* in cultivation today. In the Yulania struggle against cold, unfavorable conditions, a polyploidy was effected, transforming the basic primitive diploid count of (2n = 38) to hexaploid (2n = 114). If the exceptional vigor and beauty of the Yulania may be attributed to this chromosome increase, is was well worth the effort.

Botanically *M. Campbellii* subspecies *mollicomata* is considered a more northerly situated variation of *M. Campbellii,* inhabiting Yunnan Province. While it is not my intention to contest the validity of botanical fact, I am in full agreement with Mr. G. H. Johnstone of England. From the practical gardener's judgement, *M. Campbellii* and *M. mollicomata* are so unlike as to rate individual listing and recommendation in nursery lists.

The word "recommendation" will appear more often when *M. mollicomata* clones are propagated and grown in direct competition with the undeniable beauty of *M. Campbellii.* There are very definite good gardening considerations to recommend *M. mollicomata* over *M. Campbellii.*

Fact has shown that *M. mollicomata* may be flowered at a much earlier age than *M. Campbellii,* experience proving *M. mollicomata* to bloom in one half the time required to flower *M. Campbellii* from seed or graft.

The more one is saddened by the brutal attack of Jack Frost on his early blooming magnolia varieties, the more constant will be his search for plants that bloom late enough to escape this vandal. Lateness of bloom appears to be sufficiently constant to constitute a characteristic of *M. mollicomata.*

Within my experience all plants considered to be *M. mollicomata* have been some shade or tint of a cool fuschia coloring, in contrast to the warmer rose to crimson coloring of *M. Campbellii* forms.

One character, which might prove significant if a sufficient number of specimens could be observed, is the coloring of the stamens. In all plants selected as *M. mollicomata* the introrse surface of the anther has no color stripe. Viewed from above the stamen boss appears *white.*

Flower buds of *M. mollicomata* are very large, shaped like a bullet, in contrast to the ovoid form of *M. Campbellii.* They appear to open in full bloom much faster from the time the perules split to expose tepal color. The peduncle supporting flower in all specimens is exceptionally strong, in 'Maharajah' pubescent; in 'Maharanee' and the *M. Campbellii* × *M. molliconata* cross, glabrous.

The foregoing observations are based on two plants which appear to be *M. mollicomata* in the Strybing Arboretum, and a *M. Campbellii* × *M. mollicomata* cross.

M. mollicomata cultivar 'Maharajah' is one of the two finest magnolias within my experience, the other being Strybing Arboretum's form of *M. Sargentiana robusta.* 'Maharajah' is a large flower of regular tepal formation, the inner four remaining upright to shield the gynoecium. The last perules split to expose a very beautiful medium fuschia violet, retaining a slight tint of this coloring throughout tepals. The last perule holds firm, after the next to last perule is shed, allowing tepals on freed perimeter to develop before those held by the last perule. (Figs 39 to 42). This is pleasing, since it effects a slight outward and downward slant of the blossom. At

Fig. 42. *Magnolia* 'Maharajah'

Fig. 43. *Magnolia* 'Maharanee'

Fig. 44. *Magnolia Campbellii* × *mollicomata*

maturity the tepals reflex slightly below the horizontal. Flowers are on the average 11 inches in diameter.

M. mollicomata cultivar 'Maharanee', is a very distinct plant from 'Maharajah.' In contrast to the robust appearance of the former, 'Maharanee' is a more refined, feminine flower. There is perfect symmetry in the blossoms, which have so little coloring as to be essentially a smooth kid-skin white of water lily appeal. The flowers average 8 to 10 inches in diameter. (Fig. 43) [1]

A seedling of a cross made by Mr. Charles Raffill at Kew Gardens between *M. Campbellii* × *M. mollicomata* is very lovely and vigorous (Fig. 44). Blending the good qualities of both parents in marked and distinguishable degree, it creates wonder as to why so few really fine hybrid magnolias exist. After all, 140,000,000 years is a long, long span of time. Man has certainly lacked vision and imagination in dealing with this genus.

This plant certainly exhibits hybrid vigor, with broadly ovate leaves, a beautiful plum-red in early Spring. It blooms profusely with china rose flowers of good substance, 11 inches across. Several days with 40 mile winds failed to damage blooms. The anthers of the plant are most decorative, favoring *M. Campbellii,* but of such great length as to surround and obscure the stigmatic column. It should be difficult for this arrangment to fail in the production of selfed seed.

[1] The names 'Maharajah' and 'Maharanee' have been registered at the Morris Arboretum which is the International Registration authority for cultivar names in *Magnolia*. 'Maharajah' was first described in the Journal of the California Horticultural Society, Vol. 24: 108. 1963. 'Maharanee' is herein described for the first time.

Reference

Janaki, E. K. The Race History of Magnolias. Annual Indian Journal of Genetics and Plant Breeding. Vol. 12. No. 2. p. 82-92.

Arboretum Activities

(*Continued from Page 22*)

From May 7 to 28 Dr. and Mrs. Fogg conducted some 30 members of the Morris Arboretum Tour on a trip to Austria, Germany, Holland, Belgium and France. An account of this excursion will be found elsewhere in this issue.

At the annual Spring meeting of the John Bartram Association, held in Bartram's Garden on June 4, the Director gave an illustrated talk entitled, "Plants the Bartrams Discovered" and before the local chapter of the National Association of Gardeners, which took place at the Morris Arboretum on June 11, he spoke on, "Some European Botanical Gardens."

Dr. Li was the speaker at a meeting of the Philadelphia Botanical Club held at the Academy of Natural Sciences on April 23. His topic was, "Ginkgo, Taxads and Conifers."

On June 3 Dr. Li left for Europe where he will spend several weeks studying in various herbaria before representing the Arboretum at the Tenth International Botanical Congress in Edinburgh in early August.

New Board Member

At a meeting of the Advisory Board of Managers of the Arboretum held on May 6, Mr. Harry E. Sprogell was elected to fill the vacancy created by the death of Mr. Charles J. Seltzer, Jr. Mr. Sprogell, a member of the law firm of Saul, Ewing, Remick and Saul, has long been interested in the activities of the Arboretum. It is indeed a pleasure to welcome him as a member of the Board.

Teaching Activities

Three members of the Arboretum staff conducted courses of instruction as part of the regular Spring term teaching program of the Department of Biology on the University campus. Dr. Fogg gave his graduate course in Plant Geography, Dr. Li taught an undergraduate course on the Taxonomy of the Flowering Plants and Dr. Allison offered a course on the Biology of the Fungi. In all three of these courses the members of the classes were brought to the Arboretum on field trips for the purpose of supplementing the information and material presented to them in lectures and laboratory on the campus.

Research Club Meeting

For a number of years the Faculty Research Club has held its final meeting of the year at the Arboretum. This year the meeting was held on Friday, June 1, and the program was provided by members of the Arboretum staff.

Dr. Fogg described the research, educational and publication activities of the Arboretum and spoke briefly of his own work on the genus *Magnolia*. Dr. Li told of his research on the flora of Taiwan and showed some pictures illustrating the various plant habitats on that island. Dr. Allison dwelt on the role of fungi in causing plant diseases, using the Azalea petal blight as an example, and mentioned some of the current investigations in progress at the Arboretum. These included laboratory study of the behavior of plant pathogenic fungi before parasitism is established and her researches on the Myxomycetes of Ecuador.

The Second Barnes Lecture

On Wednesday evening, April 16, the second in the series of Laura L. Barnes Lectures in Botany, Horticulture and Landscape Architecture was held in the auditorium of the Springside Upper School in Chestnut Hill. The lecturer on this occasion was Dr. Richard A. Howard, the distinguished Director of the Arnold Arboretum of Harvard University. Dr. Howard gave an illustrated talk on, "Botanical Impressions of the African Continent." The speaker had gone to Africa in the autumn of 1963 to attend the Jubilee celebration of the founding of the National Botanic Garden at Kirstenbosch. On his way to these meetings he had traversed most of Africa from Cairo to the Cape of Good Hope and his pictures and comments resulting from this trip gave a superb cross-section of the vegetation of this remarkably interesting continent which represents the largest land mass lying between the tropics of Cancer and Capricorn.

Winter Injury

It is still too soon adequately to evaluate the effects of the winter of 1963-64 upon the plants of the Arboretum. There is no question, however, that the season just experienced was far more favorable than that of the two preceding years; temperatures were milder and precipitation was greater, especially in the form of snow which furnished a protective ground cover. The most destructive event of the recent winter was a devastating wet snow on February 21 which froze to a heavy sheath that weighted down the broad-leaved evergreens. Our worst victims were the hollies, many of which were badly mutilated on their main trunks. Strangely enough, the species most seriously affected was our own native holly, *Ilex opaca;* the European and Asiatic species suffered only minimal damage. Several of our conifers were also injured, although none of them too badly.

J. M. F., Jr.

Camellias Hardy in the Philadelphia Area

Richard Thomson

It is not generally realized that selected varieties of *Camellia japonica* may be grown with complete success in the Philadelphia area. The fable that these are only for the deep South or for greenhouse use dies hard. Any examination of the natural range of Camellias in the Orient reveals that they are grown in relatively northern areas as well as the milder sections. The truth is that after several severe winters, such as those recently experienced here, more damage appeared upon some types of *Rhododendron* than upon *Camellia japonica*.

In the recent past, there has been considerable publicity given to another species complex based upon *Camellia Sasanqua*. This was rather widely advertised as a "hardy" Camellia, and considerable commercial distribution resulted. This was most unfortunate for this area, for while the Sasanqua types are delightful, and bloom in the fall, when bloom color is apt to be sparse or lacking in the garden, they are definitely not plant hardy enough for dependable use.

Attention is directed to the phrase "plant hardy", for this is the key to hardiness distinction in the decorative Camellia group. There are very few forms of *Camellia japonica* which will not survive our winters, but there are relatively few which are "bud hardy" enough to bloom effectively after the cold weather has passed. Generally speaking, those varieties which are mid-season to late bloomers in the South will do a pretty good job in this area, but after twenty years of selection running through some forty varieties, those on the appended list appear to be the best.

Fig. 45. Camellia 'Chandleri Elegans'

Fig. 46. Camellia 'Dr. Tinsley'

If there is a secret in good Camellia culture in the Philadelphia area, it is in the correct siting of the plants. Like all broad-leaved evergreens, they are intolerant of winter sun. Plants located in warm sunny corners are inevitably rather badly damaged, and those in rather open locations, but facing North or Northwest, come through many degrees of frost (to minus fifteen degrees) without any damage at all. If it is possible to locate varieties of *Camellia japonica* in foundation planting, against a north or west facing wall, good results are almost guaranteed.

Culturally, their requirements are simple, and any soil and regimen which will grow good rhododendrons and azaleas will more than suffice. It is important that they receive adequate water, particularly when they are relatively new in the garden. Once established, they fend for themselves with great aplomb, and will reach a height of six feet or more in as many years.

It is not easy to find plants in local nurseries, but they are available. The author has little to recommend between container grown and balled and burlapped plants if they have been carefully prepared by the nursery. Planting is most important. The soil ball must be kept quite high, and the hole well filled with an organic soil mix. More Camellias have been killed by too-deep planting than any other single cause. When planted, the soil ball should rest upon a solid bottom, so it will not settle, and the top of the ball should be slightly above ground level. The fill should extend at least twelve inches on all

Fig. 47. Camellia 'Ville de Nantes'

Fig. 48. Camellia 'Ville de Nantes'

sides of the ball, and goodly depth of organic mulch should be placed over the planting, and maintained for at least two years. After this time mulching is less important, but is still beneficial. Any relatively acid material will do.

It is difficult to praise well grown *Camellia japonica* too highly. As a plant alone it is one of the most decorative garden ornamentals in existence, but when in April, with the daffodils, it bursts into profuse bloom, it becomes one of the wonders available to us. The blooms are superb, and these combined with the deep gloss of the foliage make this group a real necessity in any well ordered garden.

The appended list is intended more as a guide than a commandment. This correspondent does not pretend to have even begun to examine all of the suitable varieties. Suffice it to say that the names below have not only survived here for fifteen years in some cases, but have proved themselves to be completely satisfactory garden decoratives.

White:	Leucantha
Pink:	Berenice Boddy, Chandleri Elegans (Fig. 45), Dr. Tinsley (Fig. 46), Marjorie Magnificent, Lady Van Sittart
Red:	Glen 40, Mathotiana
Variegated:	Ville de Nantes (Figs. 47 & 48), T. K. Variegated

Diseases and Pests of Clivia

Patricia Allison[1]

Clivia miniata Regel, the most handsome of the three species of this South African genus of the Amaryllidaceae, was introduced to horticulture early in the last century. Its attractiveness lies not only in beauty of flowers, but in the rich color of the foliage and the design of the plant itself. The leaves are strap-shaped, and ascend in graceful curves from the base of the plant where their interlocked, sheathing bases create an intriguing, balanced pattern. Their color is that deep shade of green typical of well-grown *Taxus* specimens. Each year several new leaves develop from the center. When full grown they are a foot and a half to two feet long and about two inches wide. Depending upon prior treatment of the plant, it might send up a flower stalk any time between January and June. The stalk is sturdy and green, bearing at its crown a dense umbel of some twenty flowers. These, like those of many of Clivia's relatives, are deliciously fragrant. Although the umbel may be six to eight inches across, each of the blooms, composed of six tepals assembled as a broad-mouthed trumpet, is an inch and a half or two wide. In the center of each is the gracefully curved style and the filaments that are topped with large, brilliant yellow anthers. The color of the perianth varies among the several hybrids from yellow to deep scarlet. Even when cut from the plant, the flowers remain fresh for two or three weeks if kept in water. On the plant the display of color and fragrance lasts even longer. If one makes certain that pollination occurs, fruits will develop over a period of months, until at last the plant bears a crown of crimson berries.

Fig. 49. Anthracnose of Clivia leaf bases

Fig. 50. Acervulus of *Colletotrichum gloeosporioides*

Despite its many splendid attributes, Clivia has not received the place it deserves in home, greenhouse, and summer garden. In some measure this is to be expected in the north where survival outdoors is not possible through the cold winters. On the other hand, enjoyment of the glossy foliage, graceful form, and spectacular prolonged bloom should not be prevented by the numerous suggestions in horticultural literature that the plants are excessively fastidious in their cultural requirements. These reports, often conflicting, are to great degree contradicted by the behavior of the plant itself. One supects that conditions of culture that might be tolerated came to be described as necessities.

[1] The kindness and cooperation of Mr. William H. Weber are appreciated.

Fig. 51. Anthracnose of leaf blade of Clivia

Doubtless because Clivia has not yet achieved the popularity it deserves in this country, there is virtually no information available concerning the actual diseases and pests that might endanger the plant. Indeed, the genus is not even listed in the Index of Plant Diseases of the United States of the Department of Agriculture. This account, then, is an attempt to mention the principal areas of disagreement regarding culture, and to summarize current knowledge of disease and insect damage.

Disagreement Regarding Cultural Practices

Frequent mention has been made of the need of Clivia for winter "rest", during which water must be withheld to the near-wilt point, but plants in outdoor California gardens receive abundant rainfall during the same period, and bloom well nevertheless.

The need for crowded roots in often stressed. It is claimed that flowering will be prevented if the roots are not pot-bound. Thus, repotting should be undertaken only when the plant is actually "climbing" out of its container. This may be as infrequently as every five years. Strange it is, then, that some experiences are recorded of the beneficial effects of providing more root space. If crowded root systems are necessary, rather than merely tolerated, why do the outdoor plantings in California, New Zealand, and elsewhere flourish so well, unbound?

Most writers agree that Clivia does best in the shade. The authors of a popular American garden book, however, recommend that, as a house plant, it receive full sunlight.

A majority of accounts, dealing largely with greenhouse culture, recommend rather low temperatures (45-55°F) during winter "rest", followed by higher temperature (65°F) in spring. Yet Clivia is well able to withstand much higher temperatures in western gardens and in winter-heated homes in the north.

It has frequently been mentioned that growth is slow and that only an annual top dressing of soil rich in organic matter need be applied. At least one other successful grower reports that growth is so robust that several applications of soluble fertilizer are needed each year.

It would seem then, that this exceedingly interesting plant is able to surivive, grow, and flower over a wide range of cultural conditions, and that it is well worth the attention of new growers.

Diseases and Pests

Two leaf-spot fungi have been reported from Clivia. *Chaetostroma cliviae* Oud. causes blotch, a term usually applied to an ill-defined dark colored local lesion. The other, *Colletotrichum glocosporioides* Penz. (*C. cliviae* Oud.) is capable of much more damage. Its center of operations is usually low on the plant on the edges of the oldest sheathing leaf bases. (Fig. 49). These become brown and papery. Inconspicuous black fruiting structures, the acervuli, form there (Fig. 50). The spores, produced in gummy masses, can be splashed to other leaves or carried by insects. The principle damage is not to the leaf sheath, however. Rather, the oldest leaves begin to die back from the tip. Usually there is a sharp line of demarcation between the yellow and green

Fig. 52. Mealy bugs between leaf bases of Clivia

Fig. 53. Clivia with root rot.

portions (Fig. 51). If the leaf is not cut off well below the borderline, the dead area enlarges and the fungus sporulates on the dead tissue. In consideration of the fact that other forms of this same species, and other species of the genus *Colletotrichum* are capable of inducing latent disease in plants, it is not unlikely that young leaves are invaded when they are still close to the area of primary inoculum, symptoms appearing only upon aging of the host tissue. In any event, reasonable control can be achieved by cutting off diseased leaves, removing papery borders of leaf sheaths, and controlling insects. This disease, anthracnose, is second in importance to the damage caused by mealy bugs.

The very architecture of the plant makes the threat from these insects serious, for a minor infestation may be hidden among the tightly clasped leaf bases (Fig. 52). In that shelter, the sucking of the insects can cause serious damage to the young tender portions of the plant before the usual evidences of attack, droplets of sticky excrement and the insects themselves, are obvious. Feeding of young mealy bugs on the undersides of leaves at the margins results in tearing of the leaves and destruction of the beauty of the foliage. Basal feeding reduces the vigor of the plant, causes water-soaking of the tissues, and injury of flower buds. It is important, therefore, to inspect plants periodically for the first infestation and to spray promptly with an insecticide such as malathion. Because it is difficult to reach all of the hidden pests, second and third applications should follow after ten-day intervals. In greenhouses, organophosphate fumigants are ideal.

Little information is available about the causes of another trouble of Clivia, "root rot". Most healthy plants harbor on or in their root systems a variety of fungi that might be considered potential pathogens. Loss of vigor through other disease or faulty cultural practices will allow such organisms to cause additional damage. Autopsy, then, provides little information regarding the primary cause of root failure. A *Fusarium* species, for example, has been found in hairs of dead roots of Clivia (Figs. 53 & 54) . Whether or not this fungus caused the damage is unknown. Despite such ignorance, however, general recommendations can be offered for the prevention or control of root injury. These would include, of course, the use of clean heat-treated soil as a means of preventing the introduction of pathogens. Beyond this, for Clivia, there is surprising unanimity amongst writers about the need of the plant for exceedingly well-drained potting mixtures. Prevention of waterlogging is a general deterrent for diverse root rots. Furthermore, the natural vigor of the plant helps minimize the danger from this sort of disease. One grower has reported that even plants damaged as severely as the one pictured can be rejuvenated by careful root pruning, removal of dead leaves, and repotting.

Fig. 54. Root system of Clivia of Fig. 53, showing healthy and collapsed roots.

Fig. 55. "Scald" of Clivia

A parasitic nematode, *Scutellonema brachyurum* (Steiner 1918) Andrassy 1958, has been reported from Clivia. The use of pasteurized soil would prevent its introduction as well.

Two, presumably physiogenic, troubles are well known. One, "scald" (Fig. 55) , results from abrupt changes from cool, overcast days to bright, sunny ones. Prompt shading of greenhouses can reduce or prevent such damage. The leaf spots are yellow to straw-colored, with poorly defined borders. Unlike, anthracnose, the spots are usually not at leaf margins or tips, but on the uppermost part of each curving leaf.

The so-called "rust" of Clivia is not caused by a fungus at all, but can seriously affect the beauty of the foliage. Numerous, tiny, raised brown dots form on both sides of the leaves. Although reported to resemble flecks caused by bacteria, no such microorganisms have ever been observed in the tissue. The most serious example observed by the author was on a plant growing in waterlogged soil. It is not known whether or not the general health of the plant suffers as a direct consequence of the lesions.

Thus, as far as is known, Clivia is host to but a handful of troubles, the more serious of which can be handled with ease. Why not experiment with a new plant? Try Clivia.

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Stewartia Malacodendron

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Arboretum Activities

THE STAFF

In addition to teaching the summer course on Woody Plants, the Director spent several weeks in the field in New England and New Jersey collecting and photographing the native vegetation.

Dr. Li represented the Arboretum at the Tenth International Botanical Congress which was held in Edinburgh in early August.

GENETICIST JOINS STAFF

It is a pleasure to report that on July 1, 1964, Dr. Frank S. Santamour, Jr. joined the staff of the Arboretum as Geneticist.

Dr. Santamour is no stranger to the Arboretum nor to the readers of this Bulletin. He had for some years been a member of the Forest Genetics Project of the Northeast Forest Experiment Station which, until it was shifted to Durham, N. H., on September 1, 1963, had been quartered at the Arboretum.

(Continued on Page 52)

Stewartia in the Philadelphia Area

John M. Fogg, Jr.

The genus *Stewartia* is a member of the Theaceae (Ternstroemiaceae) or Tea Family which includes also *Camellia,* the Franklin tree (*Franklinia alatamaha*), *Gordonia, Cleyera, Eurya* and about a dozen other genera of tropical, subtropical and warm temperate distribution. The tea of commerce, considered by some botanists as *Thea sinensis,* is best treated as a species of *Camellia* (*C. sinensis* (L.) Ktze.).

Stewartia was described by Linnaeus in Species Plantarum (Ed. 1, 1753) and was based upon *S. Malacodendron*, a species indigenous to the southeastern United States which had been known to such early collectors as John Mitchell and Mark Catesby.

The genus commemorates John Stuart, third Earl of Bute (1713-1792), a descendant of the House of Stuart who, together with the Dowager Princess of Wales, was the creator of Kew Gardens. Despite this fact Linnaeus adopted the spelling *Stewartia* and, since there is no evidence that this was an error on his part (the House of Stuart was indeed often written Stewart), there is no justification for altering this spelling to *Stuartia* as has been suggested by Sprague, Sealy, and others.[1] A similar case exists in *Wisteria* which, although named in honor of Dr. Caspar Wistar, was published as *Wisteria* by Nuttall.[2] The International Rules of Botanical Nomenclature are very explicit on matters of this sort. They state that, unless there is evidence of a typographic or orthographic error, the original spelling of a name must be retained.

[1] See Sprague, T. A. Kew Bull. 362. 1928, and Sealy, J. R., Bot. Mag. t.20. 1948.
[2] Nuttall, T. Genera of North American Plants. 1818.

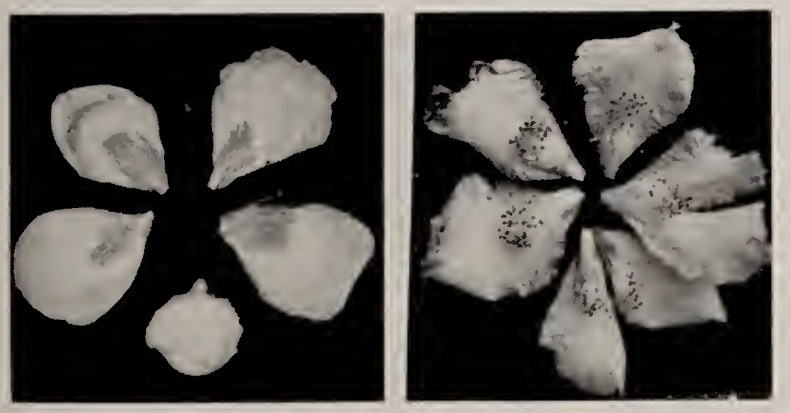

Fig. 56. Dissection of the flowers of *Franklinia* and *Stewartia*

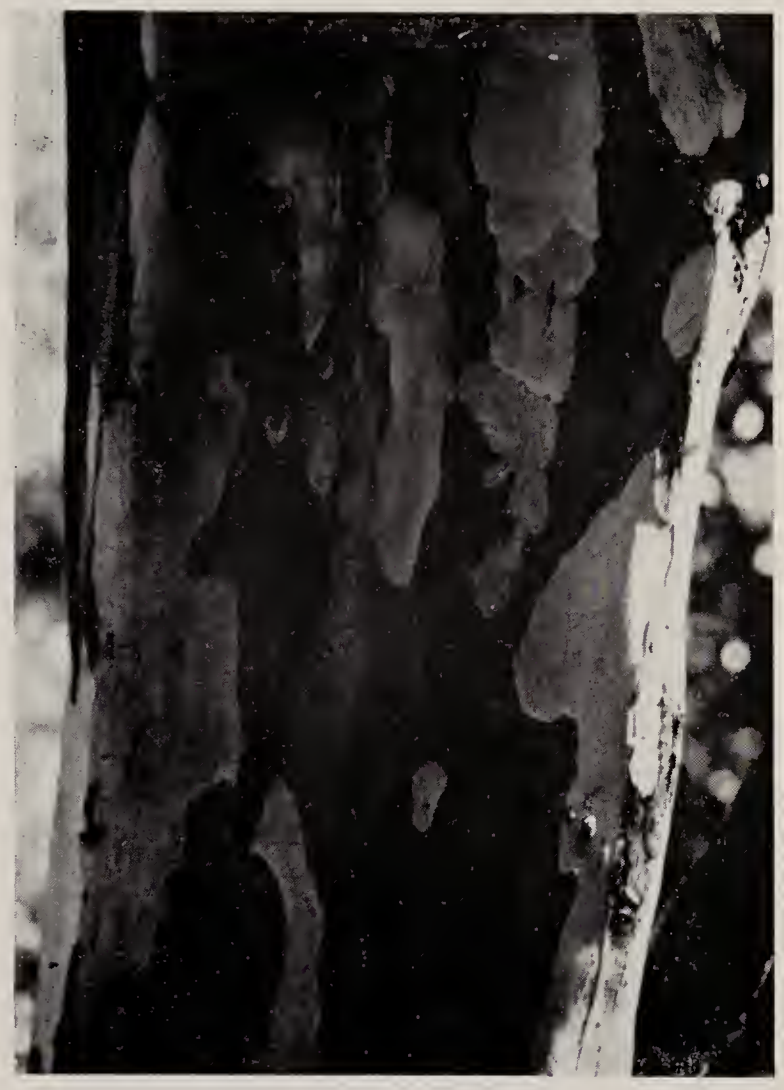

Fig. 57. Bark of *S. koreana*

Stewartia is generally regarded as including about a dozen species. Of the eight which are known to be in cultivation in eastern temperate North America, two (*S. Malacodendron* L. and *S. ovata* (Cav.) Weatherby) are native to the southeastern United States, three (*S. monadelpha* Sieb. & Zucc., *S. Pseudo-camellia* Maxim., and *S. serrata Maxim.*) occur in Japan, one (*S. koreana* Rehd.) is found in Korea, and two (*S. sinensis* Rehd. & Wils. and *S. gemmata* Chien & Cheng) come from China. This is the same type of disjunct distribution seen in such familiar woody genera as *Magnolia, Liriodendron, Liquidambar, Cladrastis, Gleditsia, Gordonia, Chionanthus,* and many others.[1]

[1] For a fuller discussion of this interesting phytogeographical relationship see Fogg, "Eastern Asiatic Plants in Eastern American Gardens". Morris Arb. Bull. Vol. 4:15-20. 1942.

Fig. 58. Ovary and styles of *S. ovata*

Characters of the Genus

The species of *Stewartia* are deciduous shrubs or trees ranging in size from about 5 m. (16 ft.) to 25 m. (80 ft.). The alternate, short-petioled leaves are crenulate or serrate on the margins and either glabrous or pubescent on the lower surface. The perfect, usually pentamerous flowers are solitary, axillary or terminal and the flat or cup-shaped showy whitish corollas are rendered even more conspicuous by a dense crown of numerous whitish, purplish or golden stamens. The five styles are either free or connate and the fruit is a woody capsule which splits into five valves when mature.

Although usually smaller, the flowers of *Stewartia,* with their crinkly white petals and indefinite stamens, bear a distinct resemblance to those of *Franklinia*. With us, however, the Franklin tree blooms in August and September, whereas the Stewartias come in flower during late spring or early summer. (Our flowering record covers the period from June 2 to July 15.) Also, in *Stewartia* all five or six petals bear groups of stamens, while in *Franklinia* stamens are attached to only four of the five petals. (Fig. 56).

Santamour[2] has shown that in *Stewartia* the diploid number of chromosomes is 30 (the same as in *Camellia* and *Gordonia*) while in *Franklinia* it is 36.

Whereas the two American species (*S. ovata* and *S. Malacodendron*) are shrubs seldom more than 5 m. (16 ft.) tall, the Oriental plants are usually trees, capable of attaining a height of 20 or 25 m. A further point of distinction is that while the bark of the American species is usually gray or brown and rough, that of most of the Asiatic ones is generally reddish-brown, peeling off in large flakes (Fig. 57). Indeed the trunks of these Oriental Stewartias are among the most ornamental of all trees hardy in this area, comparing favorably with such familiar forms as lacebark pine (*Pinus Bungeana*) and paper-bark maple (*Acer griseum*).

[2] Santamour, F. S. Cytological Studies in the Theaceae. Morris Arb. Bull. Vol. 14:51-53. 1963.

The American Species

One of the interesting points which has come to light during the present study has been a realization of the comparative rarity in this area of *S. ovata,* a species indigenous to our southern Appalachian area. In several of our gardens and arboretums, including the Morris Arboretum, plants so labeled have proved to be either *S. Pseudo-camellia* or *S. koreana,* both of them natives of southeastern Asia. There would appear to be little justification for this confusion. As already indicated, the habit and bark characteristics are entirely different. Moreover, the styles of *S. ovata* are separate, whereas those of all other species are completely united up to their stigmatic tips (Fig. 58 and 59). Other characters useful in effecting this separation appear in the keys which follow.

S. ovata, or "Mountain Camellia", is a plant of rich woods, stream banks and high ground of the Blue Ridge and adjacent Piedmont from Georgia and Alabama north to Virginia and Kentucky. It is a fine shrub with large ovate leaves, five or occasionally six pure white petals, and wing-margined seeds.

The Arboretum's only mature specimen of this species is the variant with purple filaments which is now correctly designated as forma *grandiflora* (Bean) Kobuski (Fig. 60). This plant was obtained in 1962 from the nursery of F. D. Moore & Sons in Penn Valley, Pa. Other specimens, from a variety of sources, are still in our nurseries.

Fig. 59. Ovary and styles of *S. koreana*

Fig. 60. *S. ovata* forma *grandiflora*

Another surprise which has emerged as a result of this survey has been the almost complete absence, in local collections, of *S. Malacodendron*. Most plants bearing this label have turned out to be the Asiatic *S. monadelphia*. Here again, the habit of the plants and the nature of their bark should, throughout most of the year, provide a satisfactory basis for separation. When in flower the purple filaments together with the bluish anthers of *S. Malacodendron* serve to distinguish it from all members of the genus (Fig. 61). A further point is that the very narrow, long-petioled leaves of *S. monadelphia,* with their dense silky pubescent lower surfaces, should set this species clearly apart from its congeners.

S. Malacodendron, or "Silky Camellia", is largely a plant of the Atlantic coastal plain from Florida to Louisiana and north to Virginia, Tennessee and Arkansas. In October 1962, Mr. Jacques Legendre of the Gulf Stream Nurseries showed me a colony of this plant which he had discovered 1½ miles northwest of Wachapreague, Accomac County, Virginia. This appears to be the northernmost station recorded for this species in the wild.[1]

Probably the finest specimen of *S. Malacodendron* growing in the Philadelphia area is a large plant at the home of Mr. William M. Campbell on School House Lane in Germantown. Mr. Campbell has not only permitted us to take cuttings from this plant, but has given us two small offsets which have been transferred to our nursery. We are also indebted to Mr. Henry Hohman of Kingsville Nurseries, Maryland, for a fine plant which he sent to us in the autumn of 1962.

[1] For further information on the distribution of this species in eastern Virginia see Reed, C. F., "Stewartia Malacodendron on Delmarva, Virginia." Phytologia. Vol. 10:169. 1964.

The Asiatic Species

Another consideration which has repeatedly arisen has been the confusion which appears to exist between *S. Pseudo-camellia* and *S. koreana*. Some authors, e.g. Rehder (1940), assert that in the former species the corollas are cup-shaped while in the latter they are flat. This certainly was the observation given to me by Mr. Robert de Belder of the Kalmthout Arboretum in Belgium when I asked him how he distinguished between these two species. Unfortunately, his plants were not in flower when I visited him in August 1962 and May 1964. If such a distinction exists it is not clearly evident in material which I have examined in the Philadelphia area. Corolla shape seems to vary widely on the same tree at different times of its blooming period.

When I put this question to the late C. E. Kobuski, of the Arnold Arboretum, an acknowledged authority on the Theaceae, he replied that there was really no problem. "If the plant came from Korea" he said, "it was *S. koreana*, if not it was *S. Pseudo-camellia.*" While admittedly facetious, this response may be taken as indicative of the close relationship between these two taxa. It may well be that the point of view accepted by Krüssman (1962) and others that *S. koreana* is merely a variety of *S. Pseudo-camellia* is a more realistic interpretation of this situation.

Some authors, e.g. Rehder (1940) and Krüssman (1962), have maintained that in *S. koreana* the branchlets are zig-zag and somewhat flattened, while in *S. Pseudo-camellia* they are straight and terete, or round, in cross-section. In our material this character appears to be more constant than does the shape of the corolla.

A few authors, e.g. Rehder (1940), have pointed out that in the fall the leaves of *S. Pseudo-camellia* assume a dark purple color, while in *S. koreana* the autumn coloration is more likely to be orange-red. This distinction appears to hold in our material and it is for this

Fig. 61. *S. Malacodendron*

Fig. 62. *S. monadelpha* in fruit

and the character of the branchlets that I feel inclined to maintain these two entities as separate species.

S. monadelpha as already mentioned, has very narrow leaves which are densely pubescent along the veins beneath. Also, it has the smallest flowers of any species known to us, the corollas seldom exceeding 3.5 cm. in diameter. Its two ear-like bracts render it very conspicuous when in flower and fruit. (Fig. 62). A native of Japan, introduced into this country in the early 1900's, it is entirely hardy in the Philadelphia area.

S. sinensis and *S. serrata* also have prominent foliar bracts (usually two in number) which may exceed the sepals in length. The sepals of *S. sinensis* are handsome in fruit when they assume a rich claret color (Fig. 63). Although accredited by Rehder to Zone VI, with a question mark, both of these species appear entirely hardy in our region. Superb specimens of both are to be seen in the Arboretum of the Barnes Foundation, Merion, Pa.

Fig. 63. *S. sinensis* in fruit

A Hybrid Stewartia

A hybrid between *S. koreana* and *S. monadelpha,* which arose spontaneously in the garden of Mrs. J. Norman Henry, of Gladwyn, Pa., was described as S. × *Henryae* by Dr. H. L. Li in the issue of this Bulletin for March, 1964.[1] According to the author, this hybrid shows certain characteristics of either parent species and others (such as size of corollas and length of bracts) that are intermediate between the two. Since seedlings of this hybrid have been found only under *S. koreana,* that species is assumed to be the female parent.

Stewartia at the Morris Arboretum

For many years the Arboretum's specimens of *Stewartia* were rather widely scattered throughout the grounds. In line with our established policy of bringing together the members of related groups of plants (when consistent with their ecological requirements) we sought to

Fig. 64. *S. monadelpha*

remedy this situation and in the fall of 1962 we selected a site for the Stewartias and other members of the Theaceae. The area chosen was near the top of a slope southwest of the Rose Garden and just below our Wisteria Walk. Here, we believe, the sub-acid soil and good air circulation will provide a favorable habitat for these highly ornamental plants.

At present eighteen specimens representing seven species comprise this collection of Stewartias.

Keys to Species

The following keys to the species of *Stewartia* cultivated in the Philadelphia area are offered with a view to facilitating their identification during the growing season, whether in or out of flower. They are supplemented by brief descriptions of the individual species.

[1] Li, H. L. A New Hybrid Stewartia. Morris Arb. Bull. Vol. 15:15-16. 1964.

Fig. 65. *S. Pseudo-camellia*

KEY BASED ON VEGETATIVE CHARACTERS[1]

1. Buds nearly or quite concealed by the margins of the petioles; leaves broadly rounded at the base. .....*S. ovata*
1. Buds not concealed by the petioles; leaves slightly rounded or tapering at the base.
   2. Petioles 2-5 mm. long, the length of leaves less than twice their width. *S. Malacodendron*
   2. Petioles more than 5 mm. long, if shorter, the length of leaves more than twice their width.
      3. Leaves elliptic-lanceolate, less than 4 cm. wide, densely pubescent along the veins beneath. .....*S. monadelpha*
      3. Leaves elliptic to obovate, more than 4 cm. wide, usually glabrous or only slightly pubescent beneath.
         4. Shoots pubescent, at least when young.
            5. Leaves serrate with spreading teeth, glabrous or sparingly pubescent along the veins beneath. *S. sinensis*
            5. Leaves serrate-crenulate with incurved teeth, appressed pubescent beneath. .....*S. serrata*
         4. Shoots glabrous or only slightly pubescent.
            6. Branchlets straight, usually terete. .....*S. Pseudo-camellia*
            6. Branchlets zig-zag, usually somewhat flattened. .....*S. koreana*

KEY BASED ON FLORAL CHARACTERS

1. Styles distinct and dull. .....*S. ovata*
1. Styles united and lustrous.
   2. Stamens with purple filaments and bluish anthers. .....*S. Malacodendron*
   2. Stamens with whitish filaments and yellow anthers.
      3. Corollas 2.5-6 cm. in diameter; floral bracts equaling or exceeding the sepals in length.
         4. Corollas 2.5-3.5 cm. in diameter. *S. monadelpha*
         4. Corollas 4-6 cm. in diameter.
            5. Petals whitish throughout filaments joined at the base. .....*S. sinensis*
            5. Petals reddish at the base, filaments free. .....*S. serrata*
      3. Corollas 5.5-7.5 cm. in diameter; floral bracts shorter than the sepals.
         6. Corollas cup-shaped; sepals pubescent but not velvety; seeds with acute edges. *S. Pseudo-camellia*
         6. Corollas flat; sepals conspicuously velvety; seeds with rounded edges. .....*S. koreana*

[1] The term "shoot", as here used, applies to the growth of the current season, whereas a "branchlet" may result from several years' growth.

S. ovata (Cav.) Weatherby. (*S. pentagyna* L'Hérit., *Malachodendron pentagynum* Dum. — Cours., *M. ovatum* Cav.) Mountain Stewartia, Mountain Camellia.

A shrub, up to 5 m. native to the southeastern United States. The ovate leaves are 6-12 cm. long, usually broadly rounded at the base, remotely serrulate and sparingly pubescent beneath. The upturned margins at the base of the petioles wholly or nearly conceal the buds. The large (6-7 cm. in diameter), white flowers have five or occasionally six petals, with white filaments and orange anthers. The ovate, 5-angled capsules are sharply pointed and the seeds have narrowly winged margins.

In forma *grandiflora* (Bean) Kobuski (var. *grandiflora* (Bean) Weatherby), the filaments are purple. As stated by Kobuski,[1] both this and the typical form may occur together and there appears to be no geographic segregation.

[1] Journ. Arnold Arb. Vol. XL:419. 1959.

Fig. 66. *S. koreana*

S. Malacodendron L. (*S. virginica* Cav.). Silky Camellia.

A shrub 1 to 5 m. found in rich woods and on hillsides of the Coastal Plain from Florida to Louisiana and north to Virginia and Tennessee. The petioles are among the shortest of any of the species (usually less than 5 mm. long) and the smallish ovate to elliptic leaves are serrulate-ciliate on the margins and appressed pubescent beneath. The pure white corollas are from 7 to 8 cm. in diameter and the purple filaments and bluish anthers render this species unique. The capsules are depressed-globular and the wingless seeds are lustrous.

S. monadelpha Sieb. & Zucc.

A tree up to 25 m., with flaky brown bark. Native to Japan. The narrow (usually less than 4 cm. wide) elliptic or elliptic-oblong leaves are densely appressed-pubescent on the lower surface with usually scattered hairs above. The flowers are the smallest (2.5 to 3.5 cm.) of any of our species (Fig. 64) and the pair of prominent bracts further facilitates recognition of this plant in the fruiting condition. (Fig. 62).

S. sinensis Rehd. & Wils.

A shrub or tree up to 10 m., with dark brown flaky bark. Native to central China. In both this and the following species the young growth is pubescent and in both species the bracts are conspicuous, appreciably exceeding the sepals in length. The leaves of *S. sinensis* are usually elliptic-obovate, 5 to 10 cm. long and serrate on the margins with spreading teeth. They are sparingly pubescent or glabrous beneath. The cup-shaped corollas average 5 cm. in diameter and the petals are whitish throughout. The filaments are joined together for about one-third of their length.

S. serrata Maxim.

A small tree with brown flaky bark. Native to Japan. Although this species resembles the preceeding one in several respects, it differs in its leaf-margins which are generally crenulate with incurved teeth, its petals which are reddish at the base, and its filaments which are free and distinct rather than connate at the base.

S. Pseudo-camellia Maxim. (*S. grandiflora* Briot. *S. japonica* var. *grandiflora* Hort.)

A large shrub or tree up to 20 m. with reddish bark, peeling in large flakes. Native to Japan. The elliptic-ovate or obovate leaves of this species are 2 to 8 cm. long, cuneate at the base and acuminate at the apex; they are crenate-serrulate on the margins and usually bright green and essentially glabrous beneath. According to some observers the leaves assume a dark purple color in the autumn. The branchlets tend to be straight and terete, rather than zig-zag and flattened, and the axillary flowers are 5 to 6 cm. in diameter and when fully opened are somewhat cup-shaped (Fig. 65).

S. koreana Rehd. (*S. Pseudo-camellia* var. *koreana* (Nakai) Sealy).

A tree up to 15 m. with upright branches and reddish-brown flaky bark. Native to Korea. According to its author, this species differs from the preceeding one in having flowers nearly flat, instead of cup-shaped (Fig. 66); branchlets zig-zag and somewhat compressed, instead of straight and terete, and seeds with rounded rather than acute edges. When to this are added the character of the pubescence of the sepals and the differences in autumn coloration of the leaves, it would appear that there was ample justification for maintaining these two taxa as distinct species.

S. gemmata Chien & Cheng.

This species was described in 1931. Its authors state that it is closely related to S. *monadelpha* from which it is separated by having glabrous branchlets, distinct winter buds with five to seven imbricated outer scales, crenulate-serrulate leaves with pilose under surfaces, orange-yellow anthers and larger capsules. From *S. sinensis* it differs in its pale brown, smooth bark, its ovoid smaller capsules, its completely hairy ovaries (those of *S. sinensis* are pubescent only on the lower portion), and its longer pedicels.

At present this species is not known to be in cultivation in the Philadelphia area, but we have been promised material of it by the National Arboretum in Washington, D. C.

Among other recently described species, none of which is believed to have been introduced into western horticulture, are: *S. epitricha* Nakai and *S. sericea* Nakai, both from Japan, and *S. villosa* Merrill from China.

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Some Observations on Needle Variegation in Pines

Frank S. Santamour, Jr.[1]

Variegation in the foliage of members of the genus *Pinus* is known only in three species: *P. densiflora* Sieb. & Zucc. (Japanese red pine), *P. Thunbergii* Parl. (Japanese black pine), and *P. Griffithii* McClell. (Himalayan white pine). Such aberrant types are of interest to the geneticist both for the basic objective of determining the mode of inheritance of the abnormality and the applied objective of utilizing the expression of the character as a "marker" in hybridization programs aimed at tree improvement. For these reasons, a small study of needle variegation was undertaken in 1959, utilizing trees growing at the Morris Arboretum.

At that time the Arboretum contained specimens of all three variegated types: *P. densiflora* 'oculus-draconis' (dragon-eye), *P. Thunbergii* 'oculus-draconis' (dragon-eye) (Figs. 67 and 68), and *P. Griffithii* 'zebrina' (zebra) (Fig. 69). These cultivars had all been propagated by grafting.

Both of the dragon-eye types were described by Mayr in 1890 as having leaves marked with two broad yellow bands. The yellow bands in the Arboretum trees were generally diffuse, with indistinct boundaries. The clarity of the bands varied from year to year, being more pronounced in dry years. In this connection it is interesting to note a slash pine that showed variegation during a drought period but regained normal color after the drought ended (Downs, 1949).

[1] Geneticist, Northeastern Forest Experiment Station, Forest Service, U. S. Department of Agriculture. The research reported here was conducted by the Northeastern Station in cooperation with the Morris Arboretum of the University of Pennsylvania, Philadelphia, Pennsylvania.

Fig. 67. *P. densiflora* 'oculus-draconis'

Fig. 68. *P. Thunbergii* 'oculus-draconis'

P. Griffithii 'zebrina' was described in 1889 from France, and is characterized by Elwes and Henry (1910) as having "Leaves marked an inch below the apex with a cream-coloured band". Bailey (1948) reported "leaves with yellow areas giving the foliage a banded or zoned appearance". Whether the difference in the two descriptions regarding the number of yellowish zones was the result of continued selection from the same type, or a new mutation, is uncertain. Our specimen conforms to Bailey's description, with 2 to 7 (average 5) bands per needle.

The yellowish areas in all three types usually appear as that section of the needles emerges from the fascicle sheath, and may be considered of meristematic origin. These areas become more distinct with increasing age. Occasionally, yellow areas develop in older sections of needles that had previously been green, especially in *P. Griffithii* 'zebrina'. Although all needles of a fascicle generally show the same zonation pattern, sometimes one or more needles varies in a particular area. This variation occurs most frequently in 'zebrina', which has five needles per fascicle.

The duration of needle variegation varies between the dragon-eye and zebra types. In dragon-eye trees, variegation is present only in young needles during the first growing season from the bud. Both Japanese species retain old needles on the trees for three or more seasons, but in the variegated cultivars the yellow bands begin to disappear during the winter after needle formation and one-year-old needles are completely green by the following summer. The needles of *P. Griffithii* and its zebra cultivar are

Fig. 69. *P. Griffithii* 'zebrina'

generally retained for only one year, so that during mid-summer most of the needles on the zebra tree were variegated. However, some older needles remained attached on heavily-shaded branches. One-year-old needles retained their variegated pattern but the two-year-old needles were either completely green or retained only a portion of the former pattern. The disappearance of the yellow bands, or "greening up", in 'zebrina' proceeded from the needle bases; thus the patch nearest the tip of a needle was most likely to remain yellow.

The cause of needle variegation is considered to be of genetic rather than pathological origin. In other plants, viruses may cause variegation or striping of the foliage, but Bawden (1950) stated that there was "no virus known that attacks gymnosperms". It has also been noted that, in the propagation of variegated types by grafting on non- variegated stocks, the needles on stock branches did not become variegated during the period they were allowed to remain after grafting. Likewise, transfer of pine spittlebugs from variegated to normal plants caused no variegation in the new hosts. Thus viruses probably can be discounted as a cause of needle variegation in pines.

Controlled Pollination Studies

A small study of the mode of inheritance of the dragon-eye character was undertaken in 1959, using a single tree of each variegated type and normal trees of the same species. All of the trees were small, and were located in an abandoned nursery area on the Farm section of the Arboretum.

Pollination techniques, using fresh pollen and synthetic sausage-casing bags, were as described by Wright (1959). Crosses made and results obtained are presented in Table 1.

Cones were collected while still green on September 4, 1960 and allowed to air-dry. The dry cones had to be torn apart to extract all the seed. The seed was stored dry in a refrigerator until November, 1961. Then, after cold-water-stratification in a refrigerator for one month, the seed was sown on December 15 in flats in the greenhouse. By February 27, 1962, germination had ceased. Losses due to damping-off were low and not disproportionate in any one seedlot.

The seedlings were left in the original flats in the greenhouse until the fall of 1963. Under these conditions, the seedlings underwent from one to three growth flushes after the initial seedling stage.

Needle variegation appeared only in the progeny derived from self-pollination of *P. Thunbergii* 'oculus-draconis'. The cotyledons and primary needles of these seedlings were completely green, as were the few secondary needles that appeared during the first growth period following germination. During the second growth period, the new needles showed a slight yellowish cast but were not markedly different from the yellowest of the out-crosses and no zonation was apparent. It was only during the third growth period, which began between January and June, 1963, for this progeny, that the new needles exhibited the characteristic dragon-eye variegation. All six seedlings of this progeny behaved in a similar manner.

No variegation appeared in any of the F_1 progeny of the cross of normal *P. Thunbergii* with the dragon-eye cultivar, even though all of these seedlings had undergone three or four growth periods.

Generally, no definite statement as to the mode of inheritance of a character should be made until the F_2 or backcross generations have been analyzed. A minimum period of about 7 to 10 years will be required for the production and analysis of the F_2 generation of these pines. However, with the transfer of the genetics unit from the Morris Arboretum, and a shift in research emphasis, it was felt that some interpretation of these early results was justified. Based on the lack of variegation of outcrosses and the presence of variegation in the inbred progeny, it can be inferred that the expression of the dragon-eye character in *P. Thunbergii* is probably controlled by a single recessive gene.

One additional possibility is that the character is inherited maternally that is, it may be conditioned by some cytoplasmic factor. This is only mentioned because no plants grew from seed produced by normal *P. Thunbergii* pollen on the dragon-eye parent. The question of cytoplasmic inheritance may be settled when plants of this kind are grown.

TABLE 1. RESULTS OF CROSSINGS IN DRAGON-EYE PINES, 1959.

Female parent	Male parent: none	wind	self	*Thunbergii*	*Thunbergii* dragon-eye	*densiflora* dragon-eye
Thunbergii	3	–	–	–	8	3
	2	8	–	–	6	3
	0	96	–	–	49	0
	0	0	–	–	20	0
Thunbergii dragon-eye	2	–	5	3	–	–
	2	–	5	2	–	–
	0	–	41	50	–	–
	0	–	6	0	–	–
densiflora	4	–	–	3	14	9
	0	25	–	3	10	8
	0	10	–	0	0	51
	0	3	–	0	0	4
densiflora[1] dragon-eye	1	–	1	1	4	–
	–	–	–	–	–	–
	–	–	–	–	–	–
	–	–	–	–	–	–

Legend: 8 Flowers pollinated
6 Cones collected
49 Full seeds
20 Seedlings

[1] Tree stolen after pollination

The F_1 hybrids between *P. densiflora* and its dragon-eye cultivar likewise showed no variegation. The unfortunate loss of the dragon-eye parent before the seed matured has left unanswered questions concerning the mode of inheritance of dragon-eye in this species, and whether the gene for dragon-eye is at the same locus in both Japanese species.

The single specimen of *P. Griffithii* 'zebrina' growing at the Arboretum, although approximately 35 feet tall, has produced only a single female conelet in the last six years, and this was destroyed by cone beetles. Good crops of male conelets were produced in 1962 and 1963. Pollen from the 1962 crop was used in controlled pollinations of normal *P. Griffithii* and *P. Strobus* L. (Eastern white pine). Of 33 *P. Griffithii* conelets pollinated, only one matured, and no full seeds were formed. Of 43 conelets pollinated on *P. Strobus,* 8 matured and yielded 109 full seeds. Further studies will be required to determine the inheritance pattern of the zebra character.

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Arboretum Activities

(Continued from Page 42)

A native of Lowell, Mass., educated at Yale, Harvard and the University of Minnesota (where he received his Ph.D.), Dr. Santamour served as Research Assistant of the Cabot Foundation at Harvard before joining the U. S. Forest Service in 1957.

Although primarily a geneticist, Dr. Santamour is also a competent cytologist and bio-chemist. He has contributed numerous articles to this Bulletin and the present issue contains his account of variegation in pine needles.

Summer Course

For the tenth successive year the Director conducted a six weeks' graduate course on Woody Plants under the auspices of the Summer School of the University of Pennsylvania. Mr. A. Edward Murray, Jr., graduate of Rutgers and the University of Illinois and at present working for his doctorate at Pennsylvania State University, functioned very effectively as collector and instructor.

About one half of the 24 students in the class were high school teachers of science who were enrolled in the course as participants of the National Science Foundation's Summer Institute. Also in attendance were nine graduate students of the University's Division of Landscape Architecture, for whom this is a required course. In other words, it is the conviction of the Division that their graduates should acquire familiarity with a wide range of plant material.

Three students registered through Summer School Office for graduate credit in Biology.

As in the past, members of the class learned to identify and recognize more than 500 species of trees and shrubs. This was accomplished by laboratory analysis, daily walks through the Arboretum and field trips to surrounding areas of botanical interest including an all-day excursion to the Pine Barrens of New Jersey.

Special Collections

Most arboretums, in addition to their routine representation of families, genera and species of woody plants, have established special groupings of plants which have been assembled either because they were related taxonomically or ecologically or for some other reason.

Probably the oldest special collection at the Morris Arboretum is the Tropical Fernery which was created by Mr. Morris at the beginning of the present century. Another early collection is the Rose Garden which was established in the 1920's by Miss Morris in memory of her brother.

Our series of hardy clones of English ivy (*Hedera Helix*) which are growing on the trunks of a double line of scarlet oaks in Oak Row has been characterized by Dr. George H. M. Lawrence as the best of its kind in this country.

The Langstroth Bee Garden, which was dedicated in 1951, is unusual in that the plants which it includes are trees and shrubs which are visited by bees either for nectar or pollen or both.

The Michaux Quercetum, inaugurated in 1952, now covers an area of about ten acres and contains a valuable representation of "pedigreed" oaks contributed by collectors from many sections of the country.

While it is not the intention to speak of concentrations of other individual genera, such as *Magnolia, Hamamelis, Lonicera, Viburnum,* etc., passing mention must be made of our holly collection, located on the slope below the Gates Building, which now comprises 135 species, varieties, hybrids and cultivars.

One of our most ambitious undertakings has been the establishment of a Medicinal Garden, initiated in 1957 and moved to its present location in 1960. This collection, which has been fully described in an earlier number of this publication, now includes over 300 species of plants which are or have been used in medicine.

A small bog garden, started in 1961, provides a suitable site for plants of moist, acid habitats, such as *Andromeda glaucophylla, Ledum groenlandicum, Rhododendron canadense,* etc.

Also previously mentioned in these pages, has been our recently established Heath Garden, which is situated on the South slope near the Baxter Memorial. The area of this garden will be more than doubled this fall and a considerable number of new species will be added.

Dr. Wherry's small but fascinating collection of woody phloxes, described by him in Volume 14, (1962) is located at the lower end of Wisteria Walk, which is also in a sense a special collection.

Our most recent special collection is the newly planted Cactus Garden which is described in some detail elsewhere in the present issue.

Currently still in the planning stages, is a garden to be devoted to dwarf and low-growing conifers, a group of plants which is becoming increasingly popular.

All of these collections, it is felt, add greatly to the enjoyment and enlightenment of visitors to the Arboretum. J. M. F., Jr.

A Hardy Cactus Garden

Arthur B. Wells

The Philadelphia Chapter of the Cactus and Succulent Society of America was organized on November 15, 1942. For nearly ten years the meetings of the Chapter took place in the homes of the members. Then, in the spring of 1952, Mr. Joseph W. Adams who not only belonged to our organization but was also on the staff of the Morris Arboretum, suggested that it might be possible to utilize the facilities of that institution for our monthly sessions. This proposal was promptly approved and on May 18, 1952, the Society held its first meeting in the Gates Building at the Arboretum and has continued to meet there ever since.

During the twelve years since 1952 we have come to regard the Arboretum as our home and to appreciate the full use of its various facilities. These include a meeting room with projector and screen, a spacious lobby and veranda (both replete with long tables for the display of the specimens which we bring in for exhibit, exchange or sale), full library and herbarium privileges, and the use of a pantry.

Our file of the Journal of the Cactus Society has for some years been allotted space, as a guest publication, on the shelves of the Arboretum library. However, the Arboretum recently turned over to us an enclosed set of shelves in which the bound volumes of the Journal as well as many of our own books and pamphlets can be accommodated. The Chapter holds a key to this bookcase, with the understanding that the collection may also be consulted, as occasion requires, by members of the Arboretum staff.

Fig. 70. Cactus Garden in course of preparation

Fig. 71. Cactus Garden after planting

At a meeting of the Society held at the Arboretum on March 8, 1964, the question arose as to the possibility of establishing an outdoor collection of living cacti. This problem was referred to Dr. Fogg, Director of the Arboretum, who promptly offered to place at our disposal a strip of land approximately 15 feet wide and 65 feet long at the foot of a high retaining wall directly behind the Gates Building. Protected from north and west winds by this wall, the proposed site enjoys a favorable exposure ensuring full sunlight at all seasons of the year.

Our members discussed and approved this proposal. Mr. Wells suggested that the Society should purchase a collection of hardy cacti belonging to the widow of the late Richard S. Carey of Southampton, Bucks County, Pa. This collection had come to the Careys, via Mrs. Eva Bewley, from the Karr Kactus Nursery in Canon City, Colorado. In the issue of Colorado Cactophiles for December, 1963, Mr. Carey was characterized as "an enthusiastic booster for the Colorado 'winter hardy' cacti as the most adaptable cacti for outdoor gardens on the Atlantic seaboard".

Since the plants which Mr. Carey received from Colorado had survived the winters of 1962, 1963, and 1964 in his garden it may be reasonably supposed that they will prove hardy in the Philadelphia area. Approval was therefore given for the purchase of these plants and on June 14, 1964, a truckload of cacti from the Carey Garden was delivered at the Arboretum.

Fig. 72. *Echinocereus dasyacanthus*

Through various circumstances, the actual planting was delayed until July 11 when members of the Society assembled to create the new Hardy Cactus Garden (Fig. 70). The land was cleared and a dressing of several tons of bar sand was added. On this occasion a total of 119 specimens, representing about twenty different species, was planted out, ranging from the taller branching opuntias near the foot of the wall at the back, to the lower-growing or prostrate forms near the front (Fig. 71).

On August 20 Mr. Wells embarked upon the difficult task of numbering, measuring, naming and recording the entire collection. A complete copy of his report will be preserved in the files of the Society, with a duplicate on deposit at the Arboretum. Two days later Mr. Wells returned to contribute a fine cluster of *Opuntia sphaerica* and a handsome plant of *Echinopsis multiplex*. He also added, from Mrs. Karr of Colorado, specimens of *Echinocereus Baileyi* and *E. dasyacanthus* (Fig. 72). These brought the total number of plants in the garden to 123, comprising 24 species and varieties.

Fig. 73. *Opuntia compressa*

Although other species of potentially hardy cacti will doubtless be added to augment this planting, it seems desirable to place on record the following list of names which at present constitute the collection:

Echinocereus Baileyi
E. caespitosus
E. dasyacanthus
Echinopsis multiplex
Neobesseya missouriensis
Opuntia arborescens
O. aurea
O. compressa (Fig. 73)
O. compressa var grandiflora
O. Engelmannii
O. floccosa var. denudata
O. fragilis

Fig. 74. *Opuntia rhodantha*

O. hystricina
O. Kleiniae
O. phaeacantha
O. polyacantha
O. Rafinesquei
O. rhodantha (Fig. 74)
O. rutila
O. Schweriniana
O. sphaerica
O. trichophora
Pediocactus Simpsonii

In future issues of this Bulletin we shall report on the behavior of these plants as well as the addition of other supposedly hardy species. The members of the Cactus and Succulent Society are happy to have this opportunity of testing cacti for winter hardiness at the Morris Arboretum.

Associates' Corner

An Indoor Orchard

In my account of the Arboretum's herbarium in our March issue I confined my remarks chiefly to the pressed and dried mounted specimens which are filed in the cases. I did, however, promise to tell of the collection of fruits which constitute an integral part of this herbarium, and Autumn would seem to be the appropriate time to do so.

Obviously it is impossible to mount a grapefruit or a large pine cone on an ordinary sheet of herbarium paper and file it in a standard sized pigeon-hole. For this reason some of the cases are equipped with trays which slide in and out, instead of pigeon-holes. The distances between these trays can be adjusted to fit the size of the specimens stored upon them. Cases of this sort are also used in natural history museums for storing bird—skins, shells, minerals, fossils, etc.

One whole case in the Arboretum herbarium is devoted to the storage of acorns. These were obtained at the time that the Michaux Quercetum was started in 1952. The always alert Arboretum staff took advantage of this activity and botanists from all over the country and abroad were invited to collect acorns from carefully selected oak trees and send them to the Arboretum in batches of 120 or 130 each. One hundred acorns of each collection were planted, the remainder were placed in specially constructed containers which, after being given serial index numbers, were stored on the trays of this special case. The result is that the Arboretum has one of the finest collections of acorns in existence.

In August of this year, Mr. Edi Guhardja, a student of oaks from Bojor, Indonesia, spent a week at the Arboretum devoting his entire time to studing and measuring the acorns in this collection. I don't think he even took time off to visit the New York World's Fair, being too entranced with what the Arboretum had to offer.

Some trays in other cases are devoted largely to conifers. The cones of some pines, spruces, firs, and cedars are rather bulky and are much more easily filed in this way than by regular mounting methods. The same is true of chestnut burs, coconuts and many tropical fruits. Among the latter is the fruit of the cannon-ball tree and a six inch long, spine covered pod of one of the Bignonias.

The so-called cones of some of the Magnolias are likewise too large to be attached to the standard mounting sheet and a series of these will also be found in this indoor orchard.

Much of the collection is fascinating from a design and artistic angle and those Pod and Cone Buffs who like to decorate with this material can glean interesting ideas — possibly combining some of our native offerings to produce similar results.

Whether you are so inclined or not, a visit to this remarkable orchard will prove most rewarding.

Marion W. Rivinus

New Associates

The Arboretum is happy to welcome the following new associates who have been enrolled since June, 1964:

Mrs. Susan Appel
Dr. John B. Bartram
Mr. George Behr
Mr. David Boorse
Dr. J. R. Burgess, Jr.
Mrs. Elsie B. Carson
Mr. W. W. Gilmore
Mr. Roger W. Hallowell
Mrs. Maurice Hecksher
Mr. Leo D. Jones
Mrs. Russell Kent II
Mrs. Joanne R. Marini
Mrs. Burton Mass
Mrs. Noreen McCoy
Mrs. Klauder Parker
Dr. & Mrs. Paulding Phelps
Miss Mary Powel Philips
Mrs. Frank Roberts
Mr. Sanford P. Sher
Mrs. Pemberton H. Shober
Dr. J. George Sommer
Mrs. O. S. Sprout, Jr.
Mr. Magnus Stender
Mr. Derik F. Sutphin
Mr. Stanley Tracton
Mrs. Richard Tunis
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Calluna vulgaris var. *hirsuta*

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Contributing	$ 5.00 a year	Supporting	$ 25.00 a year
Sustaining	$10.00 a year	Sponsoring	$100.00 a year
		Donor	$500.00

Arboretum Activities

THE STAFF

On September 15 the Director gave an illustrated lecture on Magnolias before the Germantown Horticultural Society. From September 29 to October 3 he represented the Arboretum at the meetings of the American Horticultural Society and the American Association of Botanical Gardens and Arboretums, both of which were held in New York.

Beginning October 15 and continuing for eight Thursday mornings, the Director presented a series of clinics entitled "Plants and Environment" for the Pennsylvania Horticultural Society. On November 10 he gave an illustrated lecture on "Research in our National Parks" before the Hill and Hollow Garden Club and on November 12 he spoke to the Philadelphia Chapter of the American Rhododendron Society on "Some European Botanical Gardens."

On September 12 Dr. Allison gave an illustrated lecture before the Pan American Association on her experiences in teaching mycology at the University of Guayaquil in Ecuador during

(Continued on Page 71)

Heaths and Heathers

Mary M. Martin

Heathers are fascinating plants throughout the entire year, and if varieties are carefully chosen there are few weeks when they will not provide at least a spot of bright flower or foliage color. Because the climate in the Philadelphia area does not offer ideal heather gardening conditions and because some attempts at growing them have met with failure, many gardeners deprive themselves of the pleasure of cultivating a most versatile group of plants so far as length of bloom, variety of foliage texture and habit, and adaptability to small or large garden areas are concerned.[1]

This article is not intended to offer an immediate education on heather gardening, nor to acquaint one instantly with all of the many species and varieties, but rather to relate our experiences with heather and to offer suggestions for their success in our area in hopes that those who have expressed even a mild interest will be encouraged and those who have not even thought of heathers as plants for our gardens will become interested in them.

I saw heathers for the first time in a garden in lower Bucks County. It was mid-January and the garden was all white and varying shades of grays, browns and greens. Struggling up through the snow was a tiny plant displaying the brilliant red winter foliage of *Erica cinerea* 'Golden Drop.' My interest was sparked and a year later I offered to over-winter several heather varieties at the Morris Arboretum greenhouses in exchange for one of each of the varieties. I believe those plants have served as a nucleus for the Heath Garden now being established at the Arboretum.

When I became interested in heather I was equipped with a few years' experience in growing various woody plants and a great many admonitions and discouragements from people who had grown heather in Great Britain and Europe, and from gardeners who had tried one or two plants and had failed. I was determined that I would try to establish a collection but knew that in order to accomplish this I would have to discard much of the advice I had received and rely primarily on experience with related plants, and to improvise when certain conditions thought to be necessary could not be met in our climate.

Heathers (*Calluna*) and heaths (*Erica*) appear to be very much alike. Both belong to the Heath Family (Ericaceae), that very large group which includes *Rhododendron, Kalmia, Arbutus, Enkianthus,* and many others. *Erica* or heath is described by Rehder as "Evergreen shrubs or rarely small trees; winter buds minute; leaves usually whorled, short-petioled, small, usually strongly revolute and linear; flowers terminal or axillary and often forming terminal spikes or panicles; calyx free, 4-parted; corolla campanulate, tubular or ventricose; lobes usually 4, very short, white, pink, or rarely yellow; stamens subglobose, 4-valved, loculicidal, enclosed in the persistent corolla; seeds many, minute. About 500 species, mostly in South Africa, also in the Mediterranean region and Central and Northern Europe."

Calluna vulgaris or heather, on the other hand, is mono-typic and is found only in Europe and in Asia Minor. It is described by Rehder as follows: "Evergreen small shrub; winter buds minute, with few scales; leaves scale-like, opposite, 4-ranked, sessile, keeled; flowers in terminal spikes; calyx 4-parted, colored with 4 small bractlets at base, longer than the 4-parted campanulate corolla, both becoming scarious and persistent; stamens 8, shorter than corolla, with 2 reflexed appendages on back; style slender, about as long as calyx; capsules 4-valved, septicidal, included in the persistent perianth, few seeded."

While these are no doubt rather involved descriptions, it is probably sufficient to remember that in *Erica* the leaves are whorled and short-petioled while in *Calluna* they are opposite and not stalked or petioled. In the literature the terms heather and heath seem to be in etymological confusion and are used interchangeably. For the purposes of this article we will allude to both *Calluna* and *Erica* as heather except when individual species or varieties are referred to.

The Culture of Heathers

Borderline hardy plants often do better on north or east facing slopes because temperature fluctuations are not so severe and late winter and early spring damage is usually less. Our heather garden is planted on a south facing slope. This particular site was chosen for much the same reason that most garden areas are selected — there was no other place to put it. This first infraction of heather planting rules seems to have worked out very well.

[1] Cover and Figs. 75-77 by Barbara H. Emerson.

Fig. 75. Heather Garden at Harwich Port, Massachusetts

The soil directly beneath a rather poor turf was a hard-packed clay which was essentially fill material pushed into a retaining bank below a flagstone terrace. The turf was peeled off by a small bulldozer and the contour of the existing steep to gentle slope was modified only slightly by the addition of top soil. The garden itself is approximately 50 by 20 feet. There is no retaining wall at the lower end of the bed but rather a line of stones to define the bed. Admittedly this creates a grass clipping and weeding problem, but since our aim was to create a gradual transition from lawn up the slope to the heather area, this was to be preferred to a retaining wall of any significance. A few large boulders from a local construction area were random-placed, sunk into the soil to about one-half their depth. Small rocks and stones were scattered through the garden to give the appearance of a rocky slope. The location of the bed permits extension as more varieties are added to the collection.

In his chapter on Soils in "The Heather Garden", Mr. Fred J. Chapple says, "Too many fallacies on this subject (soils) have been allowed to spread into the mind of the average gardener; they have on the whole done more harm than good and deterred many from cultivating heathers." Had we relied upon the information gotten from many gardeners and most books we would never have attempted a heather garden because our soil was and is so different from that recommended and thought to be absolutely necessary. When we go to extremes in trying to duplicate soil conditions we often simply deny ourselves the pleasure of growing a great many plants. Actually, where heathers are concerned, chemical fertilizers, fresh manure, heavily limed or very rich soils are to be avoided. Texture of the soil must often be created, and this is far more important than the acidity. If the soil is loose, contains a reasonable amount of fibrous material such as peat moss, has a pH of less than 7, drains well enough to permit run-off of excess water yet retains some moisture, it will probably grow the heathers that are hardy in our area.

Most heathers are compact in habit; rich soil tends to stimulate excessive growth and the plants do not retain their compact form, and flower is sacrificed to foliage. Dense, compact plants are produced on non-rich soil. Heather roots are tiny and it is important to furnish them the same type of loose-textured soil that rhododendrons and azaleas prefer. There should be no pockets of unmixed peat moss in a heather bed. While they can be grown in beds of pure peat in climates of high humidity, the watering problems that pure peat impose in our area are considerable. For this reason it is important not to plant them in soil that is not well-mixed.

Pennsylvania peat moss and half-rotted woodchips were rototilled into the top 4 to 6 inches of soil and the heathers and other heath family plants were planted directly into this mixture. The plants were watered well and the entire garden was top-dressed to a depth of 2 to 4 inches with a commercial mulch made of shredded pine bark to which we later added pine needles.

We find mulch to be highly beneficial to heathers, and for all garden plants for that matter. As every gardener knows, this past summer was exceptionally dry. Our water supply is limited and we could not water our garden. The soil in unmulched beds became hardpacked, dry, and individual plants were lost. The soil beneath the mulch was cool in most areas retained a fair degree of moisture throughout the summer. While the combination of pine needles and pine bark was seemingly satisfactory, we found that the run-off from the few showers we did have was excessive. Next year we plan to add more rotted woodchips since they soak up rainwater more effectively than any other summer mulch material that we have used. Peatmoss alone is

Fig. 76. Heather Garden on Nantucket, Massachusetts

Fig. 77. *Erica cinerea*

probably the least effective summer mulch and in some instances is harmful to the plant.

Winter mulch is beneficial since it tends to keep root temperatures constant and not subject to frequent thawing and freezing. We have used salt hay piled loosely around and partially over the plants. Salt hay will mold and rot plants very quickly, especially during the first warm days of spring, and for this reason it must be fluffed up and not be permtited to pack around the plants. The very impressive heather garden at Longwood Gardens is winter-mulched with pine boughs and needles and has been found to be very effective. All winter mulches should be removed promptly in the spring to allow the soil to become warm at the same rate as the air temperature. We have not yet applied a winter mulch since we are hopefully waiting for the fall rains and for the ground to freeze.

Our heather garden was planted in the spring. We prefer spring planting as plants then have time to establish adequate root systems for carrying them through the hot summer months. Heathers dry out rapidly and once allowed to dry there is not much hope for reviving them. Once planted, watered well and mulched, they will survive a surprising amount of dry weather. We plant heathers a little deeper than we do rhododendrons and unless the soil is too heavy this deep planting will be beneficial. Except for the more upright forms they should be planted deeply enough so that the foliage just touches the ground. If the plants have been grown in peat alone, as many nurserymen seem to prefer, it is very important to loosen the peat from the outside of the root ball; if not, the peat dries to such an extent that it is impossible to wet the roots thoroughly enough to prevent their drying.

In selecting plants from a nursery only those plants which appear to have been kept moist should be accepted. The foliage of plants growing in full sun should still be cool to the touch. and it is often easier to determine the condition of the plant by feeling the foliage than by poking at a perhaps recently watered root area. The natural transpiration of water keeps the foliage cool, and when the water in the root area has been exhausted the foliage become warm to the touch.

While books on heather tell of the beautiful meadows of plants where sheep and goats regularly crop the heath back to the roots, I do not recommend such drastic pruning in cultivation. Heathers must, however, be pruned or trimmed to keep them compact and attractive. Since we regularly take cuttings from ours we have not had to shear them regularly. It may be found that removing spent flower heads will be all the pruning required. In a large collection in which blooming extends throughout most of the year, this may be time-consuming, but there is no need meticulously to prune individual shoots unless an exotic shape is desired. The plants may be pruned or sheared with hedge clippers in early spring.

Propagation

The propagation of heather is relatively simple and since one is liable to have some losses when establishing a garden, it would be well to take cuttings of the more tender varieties so that few plants may be held in reserve for replacements. Also, it is far less expensive to establish a large bed of heather by propagating one's own plants than by buying them. I recommend propagation by cuttings rather than layering or seed since layering requires fairly good sized plants to begin with and plants from seed are rather slow to get started and varieties do not consistently come true from seed.

Depending upon the propagating facilities available cuttings may be taken throughout the growing season and well into the fall. Green-

Fig. 78. *Erica tetralix*

Fig. 79. *Calluna vulgaris*

house grown plants may be propagated any time. Cuttings taken from the first spring growth may be so soft and delicate that the water loss from the foliage will be too great; the cutting will wilt and die before it roots. We have successfully rooted cuttings from May through October. If no greenhouse or deep cold frame is available for overwintering cuttings, May or June may be the best month for taking the cuttings since it will allow enough time for them to root and to become established in pots before winter comes.

We have found that it makes no difference from which part of the plant the cutting is taken — either terminal or lateral shoots, nor is it necessary to leave a heel on the cutting. By the same token, flowering stems seem to root as well as non-flowering stems. We simply strip off the seed pods or dead flower heads. It will be found, too, that many varieties flower so prolifically that it is nearly impossible to find non-flowering wood at the time the cuttings are taken.

The environmental or external conditions into which the cuttings are placed will to a very large extent determine their success. A small piece of heather stem severed from its parent is in a highly precarious position and, unless the environment is propitious, the cutting will die before it can root. The medium, the moisture and air in the atmosphere surrounding the cutting, the temperature of both the air and medium, and the light furnished the foliage all affect the cutting.

The medium must furnish oxygen. That is, it must be light and porous enough to permit frequent penetration of water and the oxygen it carries, or at least not so impenetrable that it becomes water logged. It must be firm enough to support the cuttings and the temperature must be warm enough to stimulate rooting. We use no bottom heat for summer propagation.

We find a 50-50 mixture of German peat moss and coarse sand to be an excellent rooting medium. Different proportions of sand and peat, or sand, perlite, peat, sphagnum alone, or in almost any combination may be a satisfactory medium so long as they furnish the requirements of moisture, support, air and warmth or temperature. When mist is used to supply water, the medium should be more porous and retain less water than a medium used in a box or frame enclosed with polyethelene or glass.

The moisture in the atmosphere around the cutting must be greater than that lost through the leaves. Mist, either constantly or intermittenly supplied, a closed polyethelene frame in a semi-shaded location will usually maintain humidity high enough to offset the moisture ordinarily lost by transpiration and evaporation. Possibly the simplest structure for summer propagation is a greenhouse flat, a berry box, or shallow fruit crate, covered with polyethelene. Since the heat build-up under glass or polyethlene in full sun is extremely high, the box should be placed under a shade tree, or on the shady side of a building in order to cut down on heat.

Heathers seem to root best from small cuttings from ½ to 1 inch long. The leaves should be gently pulled from the lower third of the cutting, which is dipped into a mild rooting stimulant such as Rootone F or Hormodin #1 or #2, spaced about an inch apart, gently firmed into the medium, watered, covered and placed in a semi-shady location. They should of course be checked frequently for dryness.

After rooting, usually in 2 to 3 months, they are potted into a very light soil mixture and the pots sunk into the ground in a protected location for the winter. The following spring they may either be repotted into larger pots or lined out into beds. We trim the cuttings at the time of the second potting. They break quite soon and a compact little plant is formed very quickly.

Some varieties root more easily than others. While we have never had complete failure with any one variety, *Erica ciliaris, E. cinerea, E. tetralix* varieties and all *Calluna* varieties are almost uniformly easy to root.

Available Varieties

A surprising number of varieties and species are available in this country. All of our plants were obtained from New York and Oregon. We did attempt to import one group of plants from Great Britain, and while our experience turned out to be unfortunate and our losses were exactly 100 percent, I hasten to point out that the fault did not lie with Plant Importation, that much maligned Federal Agency in Hoboken. We found the Importation authorities to be completely cooperative and efficient. The fault lay in our

ordering late in the spring, and then having to be away when the plants arrived. They were allowed to dry out, and they simply will not tolerate casual treatment in this regard. When we have exhausted the supply of varieties available in this country, we intend to import them from Europe and Great Britain.

Because our heather garden is rather new, and because we are trying all varieties thought to be even reasonably hardy in this area, the following list includes both tender and hardy varieties. We do not recommend all of these plants as being bone-hardy in Philadelphia. Varieties which do not prove to be hardy with us might well be hardy in a more protected garden. I am sure there are other Philadelphia area gardeners who have successfully grown many of these varieties. I do not feel that a particularly severe winter, or dry summer, either proves or disproves hardiness. There are so many factors to be considered that in many instances it is virtually impossible to pinpoint reasons for the success or failure of a variety. Consistent winter killing pretty well indicates that it is simply too cold for the plant in this area. Occasional winter losses, or summer losses, should not discourage any gardener. The pleasure to be derived from establishing a heather garden; from looking for new varieties; their versatility, length of bloom and charming plant and flower habit, and their comparative ease in cultivation is reward enough in itself.

E. carnea — Mountain Heath
(bloom in late winter and early spring, cold hardy, and tolerant of lime soils)

'Cecilia M. Beale'	White
'Rosea'	Pink
'Springwood Pink'	Pink
'Springwood White'	White
'Vivellii'	Blood red
'Winter Beauty'	Deep pink

Fig. 80. *Calluna vulgaris* var. *hirsuta*

E. ciliaris — Dorset Heath
(bloom in summer, borderline hardy, said to prefer acid soil)

Forma ?	Rosy red
'Stoborough'	White

E. cinerea — Scotch or Bell Heather
(bloom in summer, possibly not as summer hardy as other Ericas)

'Atrorubens'	Ruby red
'C. D. Eason'	Red
'Coccinea'	Carmine red
'Colligan Bridge'	Red
'Golden Drop'	Pink
'Golden Hue'	Pink
'P. S. Patrick'	Purple
'Violaccea'	Deep purple

E. tetralix — Cross-leafed Heath

'Alba mollis'	White
'Darleyensis'	Salmon

E. vagans — Cornish Heath

'Grandiflora'	Pink
'Lyonesse'	White
'Mrs. D. F. Maxwell'	Cherry pink
'Nana'	Cream white
'Rubra'	Ruby red
'St. Keverne'	Bright pink

Erica Hybrids

× Darleyensis 'Arthur Johnson'	Deep purple rose
× Darleyensis (*carnea* × *mediterranea*)	Lavender pink
× 'Dawn'	Rose pink
× 'George Randall'	Purple
× Watsonii (*E. Mackaii Watsonii*)	Rose crimson
× Williamsii (*E. tetralix* × *vagans*)	Rosy-pink
× Mackiana	Bright pink
× mediterranea 'W. T. Rackliff'	White

Tree Heaths: tender in our area.
E. lusitanica — Portuguese Heath
E. stricta — Corsican Heath
(blooms from summer to fall)

Calluna vulgaris
(Flowers from mid summer late into the fall: generally hardy)

'Alba'	White
'Alba plena'	Double White
'Aurea'	Purple - gold foliage
'Camla'	Double pink
'County Wicklow'	Double pink
'Crispa'	White

'Cuprea'	Purple
'Elsa Frye'	Double White
'Flora plena'	Pink lilac
'Foxii floribunda'	Pink mauve
'Foxii nana'	Purple
'Goldsworth Crimson'	Crimson
'H. E. Beale'	Silvery-pink
'Hirsuta'	Purple
'J. H. Hamilton'	Double pink
'Kuphaldtii'	Rosy purple
'Mayfair'	Lavender
'Mair's variety'	White
'Minima'	Purple
'Mrs. Pat'	Light purple
'Mrs. Ronald Gray'	Reddish
'Mullion'	Deep pink
'Nana compacta'	Pink
'Pygmaea'	Rosy purple
'Roma'	Deep pink
'Rosea'	Rose purple
'Rubra'	Crimson
'Searlei aurea'	White
'Sister Anne'	Pink
'Tib'	Rose-crimson
'Tomentosa'	Lavender

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A New Late-Flowering Cultivar of Magnolia Soulangiana

Ralph H. Smith

In 1940 the writer purchased by mail a plant supposed to be *Magnolia Soulangiana* cv. 'Lennei'. When it first flowered at Delmar, N. Y., in 1943, it obviously was not 'Lennei', but some other form. Since nurserymen in the Albany area handle only the common, light pink to white form of *Soulangiana* which is the hardiest of all, plants for comparison were scarce indeed. Observations on the collections at Rochester, N. Y., the Arnold Arboretum at Jamaica Plain and in the New York City area showed that the plant was distinct, so that designation as a new cultivar seemed proper.

This plant has been registered under the name 'Adral', and color transparences have been filed at the Morris Arboretum. To date the cultivar exists as a single tree, 7 inches in diameter breast high and 25 feet tall. The writer is attempting to root cuttings, so that plants can be placed in the Morris Arboretum and elsewhere for comparative purposes.

'Adral' can best be described as a moderate purplish red flowered version of 'Brozzoni', with the same time of flowering, and the same size and shape of petals. At Delmar the flowers usually open between May 5 and 10, at the same time as 'Lennei', or about 10 days after ordinary *Soulangiana*, and about a week later than 'Alexandrina'. The opening buds are long and slender, colored deep purplish red (5 R P 3/9 on the Nickerson fan). The three sepals are almost as long as the 6 petals, and are similarly shaped and colored. Petals are 5 inches long and 2 inches wide, oblong-ovate in shape, only slightly concave. When full size the petals are moderate purplish red outside (5 R P 5/10), with darker veins, white inside. The flowers are fragrant.

'Adral' differs from 'Alexandrina' in flowering a week later, in the longer, more slender buds as they open, in the larger petals (5 inches long vs. 4 inches) and deeper outside color. It differs from 'Verbanica' in the larger petals and deeper outside color. It has the oblong-obovate petal shape of the almost white 'Brozzoni', which distinguishes it from 'Rustica', 'André LeRoy', 'Niemetzii' and 'Lennei', which in the plants seen have obovate petals that are concave and uniformly colored without veins, although the color is different in each cultivar. I have not seen plants of 'Burgundy' and 'San José', described as very early flowering, or 'Lombardy Rose' described as similar to 'Lennei' in petal shape and flowering time.

'Adral', like 'Lennei', flowers late enough to escape the spring frosts that frequently brown the blooms of ordinary *Soulangiana*. In its location in Zone 5b, the average annual minimum temperature is −10.3° F. In its admittedly somewhat sheltered position, it has never shown winter injury, wheras 'Lennei' was set back severely by the 1958-9 winter.

Galega Officinalis: An Adventure in Plant Naturalization

John S. Stokes, Jr.

The article, "Galega Officinalis: A Weed New to the Arboretum", by Dr. John M. Fogg, Jr., in the Morris Arboretum Bulletin for March, 1964, was read by the writer with the keenest interest. I knew this plant well, having grown it experimentally from seed in 1953 through 1955. Then came a moment of startled recollection. In the late fall of 1954 I had made a broadcast sowing of excess experimental seed of this species and some fifty others in an attempt to naturalize some of them as roadside plants along the east side of Stenton Avenue, just north of Erdenheim Avenue (identified as location (1) in the accompanying map, (Fig. 81). This was within 100 ft. of the second colony of *Galega officinalis* discovered in July of 1963 by Dr. Fogg along the west ditch of Stenton Avenue (3). The original colony discovered by him on July 9, 1963 was on low wet ground along the stream in the north meadow of the Arboretum (2).

I wrote Dr. Fogg about this immediately. The next day, March 26, I inspected the site of the original sowing (1). There I found the first spring foliage of three or four plants of *G. officinalis*. These, however, could hardly have been described as a colony and appeared just barely to be surviving, as contrasted to the colony on the west side of Stenton Avenue (3), which was dense and vigorous in growth. In the early summer of 1964 Dr. Fogg made a thorough survey of the east side of Stenton Avenue and discovered an almost continuous colony of *G. officinalis* along the banks of the rivulet (4) which drains the north side of the meadow on the grounds of St. Joseph's Academy. (Fig. 82) This rivulet empties through a culvert under Stenton Avenue and then is diverted south along the west ditch of Stenton Avenue (3) until it empties into the stream entering the Arboretum north meadow. Observed in the rivulet colony were some plants with bluish-purple flowers and others with white flowers, indicating the presence of both *G. officinalis* and *G. officinalis* var. *albiflora,* whereas the original two colonies discovered (2) and (3) contained only the white-flowered var. *albiflora*.

In July the blooming plants formed a long purple and white ribbon of color winding up the rivulet from Stenton Avenue towards the buildings of St. Joseph's Academy (Fig. 83). Subsequently, Mrs. Barbara Emerson found colonies at the upper end of the rivulet (5) reaching almost to Bethlehem Pike, three quarters of a mile to the east of Stenton Avenue. No specimens have been observed so far on the east side of Bethlehem Pike.

Dr. Fogg suggested that the additional facts brought to light since the appearance of his article warranted a further report for the record. With this in view, he, Mrs. Emerson and I inspected the various colonies on September 25, 1964 and discussed various possible ways in which they might have spread. The most plausible theory appeared to be that some of the original seed scattered in the fall of 1954 (approximately 1 oz., or 3600 seeds) had been transported to the banks of the rivulet in St. Joseph's meadow, perhaps by washing or flooding, for example during the flooding of the meadows by the torrential rains accompanying the passing of Hurricane Donna in August of 1955 (Fig. 84). After the establishment of the first plant or plants in the rivulet, the observed colonies could then have spread up and down its course through the normal cycles of fruition and subsequent distribution of seed by gravity, wind, water, birds, animals, etc. Drier soil conditions and/or periodic mowings could have prevented colonies from spreading out from the sides of the rivulet into the meadow.

The relatively late appearance of the colonies on the west side of Stenton Avenue (3) and (2) could be explained by the barrier of Stenton Avenue itself. Then, apparently, within the last several years some seed was transported from the banks of the rivulet across Stenton and into its west ditch, some lodging there and some at the same time or subsequently washing down the ditch into the stream and thence down the stream to the site of the original colony discovered by Dr. Fogg (2). This theory would account for the simultaneous first appearance of both Arboretum colonies in 1963. This view is supported by the observed vigorous spread of the colony in the west ditch of Stenton Avenue (3) an estimated additional 50 ft. from 1963 to 1964 indicating, projecting backwards, that there was little or no establishment in this area prior to 1963.

The very few plants found in March of 1964 in the original location of the seed scattering (1)

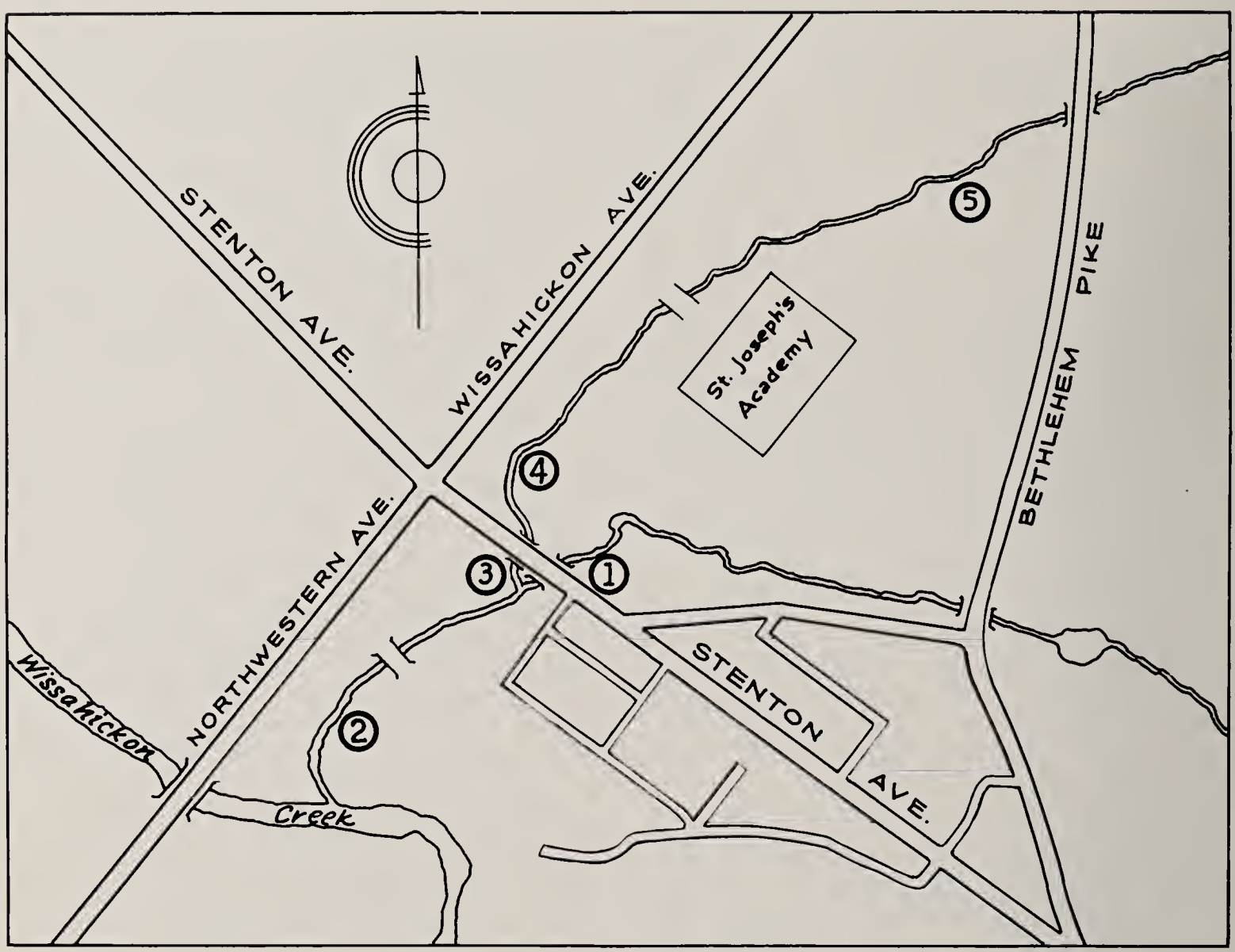

Fig. 81. Map of section of the Arboretum along Stenton Avenue

indicate that this higher, drier and perhaps otherwise culturally different location was less favorable to colonization and spreading, although it is possible that second generation seed from plants originally established here could have been distributed to start the progression of the other colonies observed. No colonies have been found along the banks of the stream in the vicinity of the original sowing (1) either to the east or to the west of Stenton Avenue, and in September the few plants observed at the original location in March were not in evidence above the ground. Perhaps this remnant of the colony at the point of the original sowing was killed by the extreme dryness of the summer of 1964 (the upper parts of some plants along the rivulet (4) were observed to be dead in September, but new growth was coming up at their bases). This, then, brings up to date our knowledge of the physical introduction and spread of the *G. officinalis* colonies in the meadows of the Arboretum and St. Joseph's Academy, now estimated to contain some 2,000 plants.

Reasons for Sowing

But why would anyone want to sow seed of *G. officinalis* in this area in the first place? In the answer to this lies another adventure: an adventure in research. The following, for the complete record, is an accounting of the circumstances which led to the original scattering of seed in 1954. The story begins in 1951 when another Philadelphian, Edward A. McTague, and I found a spare-time research and educational project in the field of the religious symbolism and use of plants. The project was undertaken on the premise that the old religious names of plants reported by herbalists and folklorists were not just idle curiosities but often had significant doctrinal and cultural content which warrant investigation today, just as the medicinal herbs of folk medicine have been found to merit careful scientific scrutiny today as possible sources of important drugs. It was and is our hope that this work will contribute to a reawakened and heightened appreciation of nature and of the religious sense of nature by many who have be-

Fig. 82. Rivulet east of Stenton Avenue

come isolated from nature by cities, books, classrooms, television, etc.

In January of 1953 one of our correspondents, Daniel J. Foley, then Editor of Horticulture magazine, sent us a copy of the manuscript of his article, "Mary Gardens", which subsequently was published in The Herbarist for 1953. In the list of plants at the end of this manuscript was the item: "*Galega lutea* — Our Lady's Cowslip". As part of our continuing program of corroborating the identification, availability, culture, symbolical form and intelligibility of plants reported to have religious names, we made a routine screening of *G. lutea*. We were unable to verify the existence of the species *lutea,* but we did note the existence of *G. officinalis,* or "Goat's Rue", a European forage plant which also had some use as an ornamental. In view of previous experience with questionable specific names from old folklore studies, which later were found to have been superseded by equivalent present-day nomenclature, we undertook to check on the culture of *G. officinalis* in our area, while continuing our screening of the reference, *G. lutea.* In the meantime Mr. Foley had eliminated *G. lutea* entirely from his final article as published, but this escaped our notice at the time.

Fig. 83. *Galega officinalis* growing along rivulet

We found *G. officinalis* in the medieval herb garden of The Cloisters, and in the course of our regular checking of rare seed catalogs, we noted the listing on page 41 of the Pearce Seed Company 1953 Catalog: "*G. officinalis,* mixed — Long-lived perennials with multitudes of tiny 'sweet-pea' blossoms in white, purple or blue-and-white", and immediately procured a packet. We found that Pearce obtained the *G. officinalis* seed in their mixture from German growers and the *G. officinalis* var. *albiflora* from English growers. According to our records we sowed approximately 300 seeds in an outdoor flat filled with loam-sand-leafmold mixture on April 4, 1953 at my then residence, 9503 Meadowbrook Lane, across from the Arboretum. By April 25, three weeks later, two seeds had germinated and by May 2 the total reached 5. Except for one seedling which damped off by May 16, the plants were transplanted to a nursery bed and raised to maturity. They first flowered in mid-June of the following year.

Fig. 84. Damage to Stenton Avenue fence following flood of August, 1955

In January of 1954 we obtained additional quantities of seed from Pearce, and were able to obtain somewhat better germination in flats of vermiculite under controlled temperatures in the 50-55° F. range. Then in the fall of 1954, at the suggestion of my association, Mr. McTague, we made the broadcast sowing of seed, including *G. officinalis,* mixed, along Stenton Avenue, as mentioned previously.

Since the blooms of *G. officinalis* failed to resemble "cowslips" (*Primula veris*) and we were unable to establish the identify of *G. lutea,* we dropped this investigation from our active list. Then, in June of 1956 I moved from my Meadowbrook Lane home and gave no further thought to the Stenton Avenue naturalization attempt until reading Dr. Fogg's article in March of 1964. Subsequently we discovered the listing: "*Gagea lutea* — Our Lady's Cowslip" in Britten

and Holland's "A Dictionary of English Plant Names" at the University of Pennsylvania Biology Library, — indicating that *Galega lutea* was a typographical error to begin with.

But then came the real surprise, the "happy ending". In the course of writing this account I checked *G. officinalis* in Marzell's Wörterbuch der Deutschen Pflanzennamen and discovered that it was one of the "Holy Hay" plants, along with sanfoin (*Onobrychis viciaefolia*) and alfalfa (*Medicago sativa*). Thus, in France it was known in some localities as sanfoin d'Espagne (Spanish Holy Hay), in Gallo-italic dialect as Sanfèin salvadegh (Wild Holy Hay) and in Germany as Ewigen Klee (Everlasting Clover). The legendary folk symbolism of forage plants bearing such names is that they were present in the manger at Bethlehem and burst into bloom when the Christ Child was laid on them . . . thus miraculously signifying, like the Star of Bethlehem, his divinity and his dominion over nature.

Somehow it seems fitting that, after our groping instrumentality, the meadow rivulet of St. Joseph's Academy is now adorned each summer with a ribbon of blooming "Holy Hay" as a tribute also to St. Joseph, who anxiously prepared the hay of the manger to receive the Holy Child for whom there was "no room at the inn".

And as *G. officinalis* works its way into the Arboretum meadow, we suggest that it should be scientifically screened (if it has not already) as a possible candidate for the Medicinal Garden, in view of Marzell's report that it was used as a treatment for the plague and was known accordingly as "Pestilence Plant", "Spot Plant" and "Pock Plant".

Plants by any other names may smell as sweet, but seen and used according to these names they may provide added sustenance for soul and body.

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1965 European Tour

The success of the 1964 Morris Arboretum Tour, which was described in some detail in the June issue of this Bulletin, has led to an appreciable number of requests for a repetition during the coming year. Accordingly, plans have been formulated for an excursion of approximately three weeks, leaving Philadelphia on May 5 and taking in Portugal, the Canary Islands, Spain and Andorra.

The party will go by regularly scheduled jet flight first to Lisbon where a day will be devoted to sight-seeing and visiting the University Botanic Garden. Trips, by chartered motorcoach, to Estoril, Sintra, Nazare, Bussaco and Coimbra will follow and on May 11 the group will fly to Madeira where three days will be spent in sightseeing and studying the local vegetation.

After returning to Lisbon the party will proceed, on May 15, to Sevilla whence, by chartered bus, visits will be made to Granada, Cordoba and Malaga. From Malaga the party will fly to Madrid where several days will be spent in sightseeing and visiting the famous Botanical Garden with an all-day trip to Toledo.

Leaving Madrid on May 22, the group will go first by plane to Barcelona, then by motorcoach to Audorra, in the heart of the Pyrenees, for two nights and a day of relaxation in some of the most beautiful mountain scenery in western Europe. Returning to Barcelona on May 25, there will be a day of sightseeing before flying home via Pan American on Wednesday, May 26.

As in 1964, this tour will be under the personal direction of the Director of the Arboretum and his wife. Anyone who is interested in further details concerning this trip should communicate with the Morris Arboretum, 9414 Meadowbrook Avenue, Philadelphia 18, Pa.

Our Northeastern Cacti: One Species or Three?

Edgar T. Wherry

In the 7th edition of Gray's Manual, 1908, p. 589, two species of *Opuntia* were listed as growing in the northeastern United States, *O. vulgaris* Mill. and *O. Rafinesquii* Engelm. The former was stated to range from Nantucket to South Carolina near the coast, and to "Falls of the Potomac," i.e., Great Falls, Virginia – Maryland, northwest of Washington, D.C.; the latter from Ohio and Michigan to Minnesota, Kentucky, and Texas. As probable synonyms of *O. Rafinesquii* were given three epithets published by Rafinesque with scarcely intelligible descriptions.

When the writer was studying the soil-reaction features of rare native plants for the U. S. Department of Agriculture in the 1920's, he found a cactus growing in country lying between the ranges outlined in Gray's Manual. With the approval of Dr. Rose, a foremost specialist on this group, he named it *Opuntia calcicola*, in reference to its growth on the limestone ledges of the Shenandoah Valley (Journal Washington Academy of Sciences, vol. 16, p. 11, 1926).

In the 8th edition of Gray's Manual, 1950, p. 1043, the interpretation of these plants was completely changed; only one species was recognized, and for it, without explanation, the long forgotten epithet *O. humifusa* Raf. was resurrected. The specific epithet *vulgaris* was pointed out to have been misinterpreted, *Rafinesquii* was treated as a synonym, and *calcicola* and the still earlier *compressa* were ignored.

The view that there is but one northeastern species of *Opuntia* was reaffirmed in Gleason and Cronquist's Manual, 1963, p. 483, but still another nomenclatural plan was followed: the earliest epithet *compressa* was accepted, and all the others mentioned above were treated as synonyms. Which of these diverse viewpoints should be accepted for labeling the northeastern cacti which have found their way into the Arboretum's hardy cactus garden described in the Morris Arboretum Bulletin for September 1964?

Having observed the plants concerned at multiple points from the Atlantic coast to the Mississippi valley, the writer would urge that there are indeed three distinct taxa. To tell them apart requires close attention to details for which the compilers of manuals scarcely have time, as well as making allowance for variability which results in features supposedly characterizing one occasionally appearing in others. In the order in which they were named, the three are:

1. *Opuntia compressa* (Salisb.) Macbr.

Pads relatively small, early becoming prostrate, pale green; areoles rather close-set, their vernal leaves (small fleshy awl-shaped objects) short and erect, bristles dull yellow, and long spines only rarely developed; flowers pale yellow, about 6 cm. across; fruits normally little longer than broad, though when shaded capable of elongation; seeds plump, their girdle blunt-edged. Range: in rather acid sandy or gravelly soil, Coastal Plain with occasional intrusions along stream valleys into Piedmont or even lower mountains.

2. *Opuntia Rafinesquii* Engelm.

Pads relatively large, early becoming prostrate, rather deep green; areoles well-spaced, their vernal leaves relatively long and spreading, bristles deep red-brown, and long spines not infrequently developed; flowers deep yellow, at times with a striking red center, about 8 cm. across; fruits normally about twice as long as broad; seeds plump with a blunt-edged girdle. Range: in circumneutral loamy soil, often on dry limestone outcrops, midland states.

3. *Opuntia calcicola* Wherry

Pads large, tending to remain upstanding, bluish green; areoles spaced, their vernal leaves short, bristles bright yellow, and long spines rare; flowers pale yellow, about 7 cm. across; fruits 2 to 3 times as long as broad; seed flattish, their girdle sharp-edged. Range: in circumneutral loamy soil over limestone and shale, chiefly in the Appalachian Ridge-Valley province, but locally extending down stream valleys into the Piedmont.

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* Gift of Dr. & Mrs. William Baltzell
** Gift of Mrs. A. C. Barnes
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††† Gift of Mary Glide Goethe Fund
†††† Gift of Dr. C. E. Wood, Jr.

Arboretum Activities

(*Continued from Page 58*)

the summer of 1963. Before the Garden Club of Plainfield, N.J., on October 21, she spoke on some of the interesting landscapes of that South American country and on November 6 she discussed "Nuclear Life Cycles in the Fungi" before the Senior Biologists at the Radnor High School.

Fall Planting

Owing to the prolonged drought, our regular fall planting program was delayed until the latter part of October. Favored, at that late date, by a scant two inches of rainfall, we were emboldened to attack the greenhouse nursery. Every available "hand" was pressed into service and within the space of three weeks more than 230 plants had moved to their permanent positions on the grounds of the Arboretum. Among the already established groups to which substantial additions have been made are: *Berberis, Philadelphus, Aronia, Prunus, Acer, Cornus, Forsythia, Ligustrum, Buddleia, Weigela, Sambucus,* and *Viburnum.*

Certain special collections have also been enriched. Our fall color areas have received new material of such genera as *Rhus, Aronia* and *Cercidiphyllum*. The collection of tender species on the protected south slope has been increased by the addition of such plants as *Abeliophyllum distichum, Orixa japonica,* and *Forestiera neomexicana*. The area devoted to the Heath Garden has been more than doubled and a few plants have been set out; many more will follow in the spring of 1965.

A Bark Collection

The recent and very welcome acquisition of three fine specimens of the Tibetan cherry, (*Prunus serrula*) has stimulated us to do something which we have long had in mind, namely, to bring together in one area a number of trees with spectacular bark characteristics. To this end we have planted the largest of these cherries in a conspicuous position along the roadway leading from the Hillcrest Avenue gate and have placed near it the following: lace-bark pine (*Pinus Bungeana*), paper-bark maple (*Acer griseum*) moosewood or striped maple (*A. pensylvanicum*), tree or Japanese clethra (*C. barbinervis*), Chinese quince (*Chaenomeles sinensis*). and two Stewartias (*S. koreana* and *S. monadelpha*). All of these trees possess bark which is remarkable either by its color or its pattern of exfoliation or both. As time goes on additional plants will be added to this small collection making it, we hope, of real interest to visitors, especially artists and photographers.

The Third Barnes Lecture

The third Laura L. Barnes Lecture on Botany will take place on Wednesday, April 21, 1965, in the auditorium of the Springside Upper School. The speaker will be Dr. H. Christian Friedrich, Curator of the Nymphenburg Botanic Garden of Munich, who will give an illustrated lecture on the gardens at Munich as well as the Alpine Garden on the Schachen in the Bavarian Alps. Further details concerning this lecture will appear in a future issue of this Bulletin and individual announcements will be mailed to our Associates.

From our Guest Book

The following are among the distinguished persons who have recently visited the Arboretum:

Dr. Benjamin Blackburn, Director, The Willowwood Arboretum, Gladstone, N. J.
Dr. Ralph E. Cleland, Professor of Botany and Dean of the Graduate School, Indiana University.
Dr. A. Orville Dahl, Professor of Botany, University of Minnesota.
Dr. Oliver Diller, Director, The Ohio Agricultural Experiment Station, Wooster, Ohio.
Dr. Erling Dorf, Professor of Geology and Paleobotany, Princeton University.
Lui Lady Forbes, London, England.
Dr. Karl F. Heumann, Director Office of Documentation, National Academy of Sciences.
Mr. Fred Heutte, Director Norfolk Botanical Garden, Virginia.
Dr. E. Lowell Kammerer, Curator, The Morton Arboretum, Lisle, Ill.
Dr. George H. M. Lawrence, Director, The Hunt Botanical Library, Pittsburgh, Pa.
Dr. George W. Longenecker, Executive Director, University of Wisconsin Arboretum.
Dr. Áskell Löve, Professor of Botany, University of Colorado.
Mr. George H. Pring, Superintendent Emeritus, Missouri Botanic Garden, St. Louis.
Dr. Russell J. Seibert, Director, Longwood Gardens, Kennett Square, Pa.
Sir George Taylor, Director, Royal Botanic Gardens, Kew, England.

Mr. and Mrs. Robert Walpole, Wicklow, Ireland.
Dr. Carroll E. Wood, Jr., Associate Director. Arnold Arboretum, Mass.

Our First Metasequoia Cones

Although female cones of the recently discovered dawn redwood (*Metasequoia glyptostroboides*) have been reported from a number of localities, e.g., England, New York, Oregon and Japan, none had been observed on any of the Arboretum's thirteen trees until the summer of 1964. We are now pleased to report that one of our largest specimens has produced approximately 40 female cones, most of them very close to the top. (Fig. 85) [1]

The tree in question which is on the south slope near the Swan Pond, was grown from seed obtained from the Arnold Arboretum in 1949. It is about 45 feet tall, which may be considered a very satisfactory performance for any tree only fifteen years of age. To date no male cones or strobiles have been found either here or, to our knowledge, elsewhere in this area and until such are produced viable seed can not be expected to develop.

J. M. F. Jr.

Fig. 85. Female cone of *Metasequoia glyptostroboides*

[1] Photograph by Elizabeth V. Orsatti.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since September, 1964:

Dr. Victor D. Bergelson

Mrs. Edward M. Davis

Mrs. Bessie Ford

Judge V. S. Haneman

Mr. John N. Hans

Mr. John K. Jenney, Jr.

Mr. Norman J. Linker

Mr. & Mrs. J. B. McCall

Mr. Charles R. Meyers, Jr.

Mr. & Mrs. Charles O'Connor

Rev. Pehr Hemming Odhner

Mrs. George Reed, Jr.

Mrs. Wm. J. Robinson

Mrs. Carol F. Schneider

Mrs. Beth A. Showell

Mr. & Mrs. Chas. H. Showell

The Don Smiths

Mrs. Theodore A. Smith

Mr. John C. Venner

Mrs. Mabel B. West

Mrs. Alfred Wielopolska

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Errata

p. 2 (left) line 9 for Greek read Creek
p. 18 Fig. 25 *Galeopsis* read *Galega*
p. 48 (left) line 1 for *Cav.* read Cav.

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Morris Arboretum Bulletin

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A portion of the Coniferetum

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THE ASSOCIATES, through whose interest and generosity *The Bulletin* and certain other undertakings of the Arboretum are made possible, is an informal group of individuals interested in encouraging and furthering the educational and research endeavors of the Morris Arboretum.

CLASSES OF MEMBERSHIP

Contributing	$ 5.00 a year	Supporting	$ 25.00 a year
Sustaining	$10.00 a year	Sponsoring	$100.00 a year
		Donor	$500.00

Arboretum Activities

THE STAFF

On January 15 the Director gave an illustrated lecture on "Relatives of the Camellia" before a joint meeting of the Norfolk Botanical Garden Society and the Virginia Camellia Society in Norfolk, Va. On January 17 he spoke to the Philadelphia Chapter of the American Cactus and Succulent Society which holds its monthly meetings at the Arboretum. The subject of his talk was, "An Introduction to Plant Taxonomy." On March 3 he talked to the Academic Year Institute of the National Science Foundation on "Botany and Medicine" and on March 10 he delivered an illustrated lecture on "New or Unusual Trees" before the Annual Flower Show Luncheon of the Garden Club of America in New York.

(Continued on Page 13)

Landscaping An Arboretum

John M. Fogg, Jr.[1]

At the very outset it should be understood that the term "landscaping" (for want of a better one), is here used in the broadest possible sense. Neither the Director nor any member of his staff is a trained landscape architect and these observations should be interpreted merely as an account of our experiences over more than a quarter of a century in attempting to transform a beautiful private garden into an arboretum. It must also be emphasized that we are dealing not with arboretums in general, but only with the Morris Arboretum.

In 1889 Mr. John T. Morris purchased some 30 acres of land in Chestnut Hill, a suburb of Philadelphia. On this property, which he named Compton, he built a house and began to assemble a collection of trees and shrubs. Over the years additional parcels of ground were acquired, so that in 1932, when the Morris estate was bequeathed to the University of Pennsylvania, it consisted of about 170 acres and contained a superb representation of native and exotic woody plants.

By good fortune the piece of land which we inherited possesses considerable geologic and topographic diversity. A ridge which forms the backbone of the Arboretum is composed of quartzite, a metamorphosed sandstone which weathers slowly to form an acid soil. To the south of this ridge the gneissic rocks disintegrate to produce a relatively neutral medium. North of the median ridge the land descends into a flat or gently undulating area of about 100 acres which is underlain by Cambro-Ordovician limestone. Thus, within our acreage, which is small compared to many aboretums, we have an exposed ridge, north - and south - facing slopes, and pH values ranging from approximately 5.5 to 7.5. Add to this the fact that the Wissahickon Creek, with its rich bottomland, forms one of our boundaries and that the grounds are traversed by two streams and watered by several springs, and it will be realized that we are very favorably endowed for the establishment of ecologically adjusted as well as taxonomically related plant groupings.

As often happens in large private estates, greater emphasis had been devoted to aesthetic values than to systematic or ecological relationships. Thus, coniferous and deciduous groups were promiscuously intermingled and honeysuckles, viburnums, lilacs, azaleas, maples, oaks, ashes, dogwoods, hollies, etc., were scattered in a hit-or-miss fashion throughout the grounds. The result, while often pleasing to the eye, was a far cry from the ideals of an arboretum which should not only be aesthetically satisfying but should seek to bring together, on soils consistent with their growing needs, plants which are taxonomically related.

One of our first projects therefore, was to take advantage of the edaphic heritage of our acid ridge and its south and north facing slopes. The summit of this ridge was designated as our Coniferetum and to the few conifers already growing there we have added several species of pines, firs and spruces as well as such genera as *Sequoiadendron, Cedrus, Taxodium, Libocedrus, Metasequoia, Pseudolarix* and *Cryptomeria*. As each specimen is set out we assume that it will grow to maturity and endeavor to provide adequate space for its maximum development. In this way we hope to avoid the "plant-bound" condition which prevails throughout so much of the older plantings on the ground. (Cover and Fig. 1).

Fig. 1. A portion of the Coniferetum

[1] Based on an article prepared for the October Newsletter of the American Association of Botanical Gardens and Arboretums and reproduced here with the permission of the editor of that publication.

Fig. 2. The Holly Slope

On the south-facing slope we have concentrated several groups of acid-tolerant families and genera. One of these is our holly collection which now comprises more than 130 species, hybrids, varieties, and cultivars of *Ilex*. (Fig. 2)

On another section we have established a Heath Garden devoted not only to numerous forms of *Erica* and *Calluna*, but also to representation of such genera as *Elliottia, Leiophyllum, Kalmia, Daboecia, Enkianthus, Zenobia, Pieris, Lyonia, Chamaedaphne, Oxydendrum, Lencothoe, Bruckenthalia, Arctostaphylos, Gaultheria, Vaccinium, Gaylussacia,* etc. The rhododendrons and azaleas, being extremely large groups, have their own allotted areas in other sections of the grounds. (Fig. 3)

Other portions of the south slope support concentrations of Theaceae (with special emphasis on *Stewartia*), Guttiferae, and Verbenaceae.

In every arboretum there should be a place for plants of tender proclivities. For this purpose we have selected, in a very protected portion of this south-facing slope, a small amphitheatre and have place in it such "tempermental" genera as *Lagerstroemia, Illicium, Osmanthus, Osmarea, Skimmia, Adina, Pistachia, Aucuba, Danae, Ruscus, Orixa, Forestiera, Abeliophyllum,* etc. Here, obviously, purely taxonomic considerations are subservient to ecological ones.

One of the features of the Arboretum most admired by visitors is the existence of its broad expanses of lawn. These are eloquent testimonies to Mr. Morris's appreciation of the value of open space. As the need for expanding our collection increases from year to year the temptation to encroach upon these open parklands is well-nigh irresistible. Nevertheless we have withstood this pressure and intend to continue doing so, our reason being that there is no better setting for trees than a foreground of grassland. Our one compromise has been to utilize the peripheries of these vast circular or oval areas of turf by establishing on them plantings of shrubs. This, we feel, can be accomplished without violating the aesthetic integrity of the original design.

Around the margin of the easternmost of these lawns we have concentrated thousands of azaleas, most of them against a background of conifers. This "Azalea Meadow", as it is called, is one of the most photogenic parts of the Arboretum from the middle to the end of May. (Fig. 4)

On the margin of another and even larger parkland area we have recently planted several large and important groups of shrubs. One of these is a representative collection of *Cotoneaster,* comprising over a hundred and twenty plants and more than forty species. Further along a home has been staked out for the Hamamelidaceae or Witch Hazel Family. Here are to be found not only most of the species and many of the cultivars of *Hamamelis, Corylopsis,* and *Fothergilla,* but also such genera as *Disanthus, Parrotia, Parrotiopsis, Fortunearia,* and *Liquidambar.*

Other sectors of this broad periphery support concentrations of *Elaeagnus, Tamarix* and tree peonies. One small area has been developed as a bog garden, enabling us to display plants of moist, acid habitats, such as *Ledum groenlandicum, Andromeda glaucophylla, Rhododendron canadense, Nemopanthes mucronata, Viburnum nudum, V. alnifolium,* etc. (Fig. 5)

One of our most ambitious efforts in recent years has been the creation of a Medicinal Garden. Located in what had previously been a conifer nursery, this collection today includes nearly 350 species of plants which are or have been used as sources of drugs. In this instance educational and utilitarian values take precedence over taxonomic or ecological ones. (Fig. 6)

Other special collections situated on the southern slope of the grounds include a Rose Garden (established in the 1920's by Miss Lydia T. Morris in honor of her brother John who died in 1915), a dry rock wall, a tropical fern house,

Fig. 3. The Heath Garden

Fig. 4. Azalea Meadow

and a small garden devoted to phloxes. In the last-named, which is the special project of Dr. E. T. Wherry, woody members of the Polemoniaceae are arranged first according to their geographic origin (those from eastern North America being in one section, those from the western half of the continent in another) and then according to their soil requirements, i.e., whether acid, neutral or alkaline. Here, on a small scale, is a fine example of the blending of geographic, taxonomic, and ecological relationships.

Several other groups of plants have been or are being located on the sub-acid to circumneutral soils of the area designated by Mr. Morris as Compton. These include maples, buckthorns, barberries and a fine collection of hardy clones of English ivy (*Hedera Helix*) which are planted on the trunks of a long double row of scarlet oaks. (Fig. 7)

Turning now to the north-facing slope of our quartzite ridge, we find that the soil changes rather abruptly from acid to prevailingly alkaline. On the declivity just below the summit we have established our major concentration of *Magnolia*. Although this may appear suicidal, it has already proved highly satisfactory. The mere fact of their northerly exposure tends sufficiently to retard the opening of the buds so that they usually escape the blasting effects of a belated cold spell in April.

The broad acres at the foot of this slope provide appropriate space for the establishment of Cornaceae, Ulmaceae, Hippocastanaceae, the genus *Paulownia* and a few other groups. Here, again, these plants are being located around the borders of a central meadow through which flows a small stream.

The 70-acre tract known as Bloomfield, which was the Morris farm, provides us with our finest opportunity for assembling several large families and effecting mass plantings of showy genera. As already mentioned, this area is largely underlain by limestone and this, to a large extent, has dictated the selection of plant material. Since most members of the Rosaceae (our largest family of woody ornamentals) flourish on neutral or calcareous soils, this group has been accorded an extensive and highly advantageous location. Here for the first time we have ample room for multiple plantings of crab-apples, cherries, quinces, spiraeas, chokeberries, sorbuses, hawthorns, and many other attractive groups.

Adjoining the Rosaceae is a smaller but still considerable area allotted to the Leguminosae, or Pea Family, with emphasis given to such genera as *Robinia, Cercis, Cladrastis, Gleditsia, Caragana, Maackia, Sophora,* etc.

Other large and important families to which space has been allotted are the Saxifragaceae, Oleaceae (with special provision for lilacs), Rutaceae, Rhamnaceae, Moraceae, and Caprifoliaceae. Not all members of the last-named family are particularly well adapted to circumneutral soils, yet we had no room elsewhere for a group of this size and it is gratifying to report that such large genera as *Lonicera* and *Viburnum* are doing remarkably well.

Another group which is certainly not at home on such soils is the genus *Quercus*. Due, however, to the exigencies of space we were forced to locate our Michaux Quercetum on a 10-acre strip along the northern boundary of our property. The several hundred young oaks comprising this collection are admittedly not doing as well as they would on an acid or neutral soil, but at least we have an opportunity to compare their behavior with that of duplicate series which have been distributed to other arboretums throughout the country.

Roadways, although at present non-existent, have been staked out for future development and when built will follow the contours of the terrain and will lead through the plantings which have already been established. In all of this

Fig. 5. The Bog Garden

Fig. 6. The Medicinal Garden

Fig. 7. Ivies on Oak Row

development we are adhering to the accepted practice of maintaining broad open areas of lawn with marginal plantings enhanced by recurrent vistas.

Finally, since one of the primary functions of an arboretum is to educate and raise the level of taste in the selection of plant materials, we have reserved a plot of about two acres for the creation of a demonstration area for the display of vines, hedges and ground covers. This project when completed, will represent, a blending of educational principles, aesthetic values, taxonomic relationships, and ecological requirements.

Book Review

A Selected Guide to the Literature on the Flowering Plants of Mexico. Ida K. Langman. 1015 pp. Univ. of Pennsylvania Press. A Morris Arboretum Monograph. 1964. $25.00.

From time to time over the last several years mention has been made in these pages of a Bibliography of the Mexican Flora which was in preparation and which, when published, would appear as a Morris Arboretum Monograph. That day has now dawned and Mrs. Ida K. Langman's thousand page volume is at last in our hands. It is beautifully bound and printed with a highly evocative dust jacket, incredibly light for its thickness (nearly three inches), impressive in its coverage of a vast literature and extremely easy to use if one will take the trouble to follow the ground rules which the author has provided.

Stimulated by a visit to Mexico in 1940, Ida Langman became interested in the rich flora of that fascinating country and soon realized that there existed no adequate guide to its extensive botanical literature. Thus began a search which has consumed a quarter of a century, has entailed many trips to Mexico, has required visits to countless libraries, and has culminated in the present volume with its 20,000 entries, its list of journal titles and its highly useful subject index.

It may perhaps be expected that in a work so monumental certain errors and omissions will be detected. The author seems to have anticipated this, for in an introductory section entitled "Random Thoughts on Bibliographies" she has practically disarmed her critics by citing a number of comments by and about bibliographers. The words of the late W. L. Jepson merit quotation here: "It's to be sure," he wrote, "disconcerting enough to have such errors, but after all the main thing is, has the book got matter in it? Is it meaty? Not is it faultless. A faultless book is impossible."

Mrs. Langman's book is so replete with matter that one can only marvel at the prodigious industry and attention to detail which its preparation involved. Its coverage is broad and includes not only taxonomic and phytogeographic literature, but works in such related fields as the history of botany in Mexico, botanical exploration, and the economic uses of plants in agriculture, horticulture, medicine, pharmacology and industry. Also included are vocabularies of indigenous languages spoken in Mexico which contain references to plant names. The volume is thus one which should be not only in every botanical library in Mexico but in every institution which is concerned with the problems relating to plant-life in the temperate and tropical regions of the New World.

J. M. F., Jr.

Chromosome Number in Corylopsis

Frank S. Santamour, Jr.

The genus *Corylopsis* (Hamamelidaceae) is of Asiatic origin and, as recently studied by Li[1], numbers about 20 species. Of these, ten are in cultivation, but only 7 or 8 are hardy in the Philadelphia area. More widespread ornamental use should be made of these attractive yellow-flowered shrubs which, like Forsythias, bloom in early spring (in mid to late April in the Philadelphia area).

The basic chromosome number in Corylopsis is × = 12, as in most of the other genera of the Witch-Hazel Family. Three species have previously been studied cytologically: *C. pauciflora* (n = 12), *C. spicata* (n = 36), and *C. veitchiana* (n = 36)[2]. Thus only diploid (2×) and hexaploid (6×) members of this genus had been reported.

In the present study, an attempt was made to extend the number of species counted and to investigate the chromosomes of a plant reported to be a hybrid. Most of the plants used in this study were growing at the Morris Arboretum but, owing to the death of certain Arboretum plants, two species were obtained from the Arboretum of the Barnes Foundation, Merion, Pa. Specimens of all plants are represented in the herbarium of the Morris Arboretum.

Flower buds were collected in late September and early October, 1964. The outer bud scales were removed to facilitate rapid fixation in 1:3 acetic alcohol. Anthers were squashed in aceto-carmine and observations made under oil immersion at a magnification of 900× .Representative plates were drawn with the aid of a camera lucida.

The following chromosome counts have been made:

	Arb. No.	Chrom. No.
C. glabrescens	M61-667	n = 24
C. pauciflora	M61-668	n = 12
C. platypetala	Barnes	n = 12
C. sinensis	M61-686	n = 12
C. spicata	M61-642	n = 36
C. Veitchiana	M61-690	n = 36
C. Wilmottiae	Barnes	n = 24
"Hybrid"	M46-495-B	n = 12

[1] Li, Hui-Lin, The Cultivated Corylopsis, Morris Arb. Bull. Vol. 13: 63-68. 1962.

[2] Anderson, Edgar and Sax, Karl, Chromosome Numbers in the Hamamelidaceae and their Phylogenetic Significance, Jour. Arnold Arb. 16: 210-215. 1935.

Of the seven species studied, three are diploid, two tetraploid, and two hexaploid. Counts for the three species reported previously were in agreement. Meiosis in all but one species was normal, and the onset of meiosis proceeded from the base to the tip of the raceme. *C. Wilmottiae* showed definite meiotic irregularities in about half of the cells observed. This may be indicative of at least a partially hybrid origin for the single plant studied.

However, another plant, presumed to be a hybrid between *C. spicata* and *C. pauciflora,*[3] was shown not to be of hybrid origin. Although this specimen was obtained in 1946 from Winterthur, Delaware, the authorities of that institution can supply no information concerning its history. A plant from this cross should be tetraploid (n = 24) and would probably exhibit abnormal meiosis. This plant was diploid (n = 12) and had regular meiosis. Although most of the racemes contained 5 flowers instead of the 2-3 normally found in *C. pauciflora,* the specimen should probably be considered as a variant of *C. pauciflora.*

Frequently, there is a relationship between the degree of ploidy in plants and the sizes of stomatal guard cells and pollen grains. Measurements of stomatal guard cells were made on collodion peels from the lower leaf surface. Guard cells of the diploids averaged 13.5 microns in length, while the tetraploids and hexaploids averaged 17.6 and 20.0 microns respectively. Pollen was expressed from anthers of unopened flower buds and stained in aceto-carmine. With the exception of *C. Wilmottiae,* all plants of all levels of ploidy produced pollen which averaged 98 percent fertility and 24 microns in diameter. Pollen abortion in *C. Wilmottiae* was 85 percent and well-stained grains ranged from 15 to 30 microns in diameter. The meiotic disturbances in *C. Wilmottiae* which gave rise to the abnormalities in pollen production may be the result of hybridity or of gene-controlled asynapsis.

[3] Li, Hui-Lin, *op. cit.*

Magnolia Grandiflora 'Charles Dickens'

Jewel W. Templeton
Winchester, Tennessee

I first saw this magnificent tree while driving about Franklin County, Tennessee, in search of specimen trees of American holly. As I rounded a curve I saw what at first glance I thought to be a large holly tree. The afternoon sun gave the "cones" a luminescent bright red quality. I was so impressed that I slammed on my brakes without a thought for the truck bearing down from behind. I was almost hit! After appropriate explanations, both the truck driver and I went to inspect the tree and to find out something about it.

Mr. Charles Dickens, upon whose property this superb specimen is growing, put in appearance and told us something of the history of the tree. It was planted about 103 years ago by a Mr. Britton who lived and operated a nursery on the place. He obviously knew plants as there are other good specimens here, among them some very fine hollies and the largest American arborvitae in this section. Mr. Dickens had lived there for about 40 years and, according to him, the tree had never been successfully reproduced. One reason for this was that, after an unfortunate experience with an unscrupulous nurseryman, the Dickenses would allow no one to touch the tree or collect seed.

I was fortunate in that Mr. and Mrs. Dickens permitted me to collect seeds and attempt to grow them. The seedlings turned out to be even more variable than is usually the case with progeny of *M. grandiflora* — which is surely variable enough!

Dr. J. C. McDaniel, of the Department of Horticulture at the University of Illinois, and several others believe that perhaps the tree is a hybrid. A root-tip examination of one of its open-pollinated seedlings made in 1962 by Dr. Frank S. Santamour of the Morris Arboretum, indicates that the tree is a 76 chromosome tetraploid. Normal *M. grandiflora* has 114 chromosomes and is the only hexaploid among the species of *Magnolia* native to the United States. Further study along these lines is needed in order to establish the parentage of 'Charles Dickens'.

Several botanists are interested in this tree and I wish to thank Dr. George Ramseur, of the University of the South at Sewanee, Tennessee, for assisting me with the following description.

Fig. 8. *M. grandiflora* 'Charles Dickens'

MAGNOLIA GRANDIFLORA 'Charles Dickens'

Leaves obovate-oblong 5 inches (12 cm.) to 4½ inches (11.25 cm.) wide, obtusely short-acuminate or obtusish, cuneate at base, lustrous above, ferruginous-pubescent beneath; petioles stout, about 2 cm. long; flower cup-shaped but widely opening, 8 inches (20 cm.) to 10 inches (25 cm.) across; sepals 3; petals 6, obovate with a short claw, upper whorl smaller than lower whorl; filaments and staminate portion of receptacles purple; cones ovoid 3½ inches (9 cm.) to 4½ inches (11.25 cm.) across, becoming extensively red; follicle tips recurved and extended 9 mm. to 1 cm. from body of cone at dehiscence; seeds are 15 mm. (3/5 inch) to 19mm. (16/25 inch) wide, aril bright lustrous red; bracts and buds are rusty pubescent. The original tree is large, pyramidal, 30½ inches in diameter 4 feet from

the ground; height 36½ feet; branch spread 60 feet; the branches are heavy beginning at 6½ and 9½ feet from the base and sweeping down so that their ends rest on the ground. (Fig. 8)

'Charles Dickens' differs from typical *Magnolia grandiflora* in its magnificent display of bright red cones for about a six to eight week period in the fall. The cones, borne in profusion from the top of the tree all the way to the ground, are brighter red, larger, more ovoid than usual, with follicle tips that are much more recurved at dehiscence. (Fig. 9) The seeds are much more oblong. The leaves are mostly smaller and less elliptical but vary greatly in size. The differences are great enough that anyone familiar with 'Charles Dickens', given a random collection of a dozen or so local magnolia cones, seeds, and leaves would have no difficulty in distinguishing them from this cultivar.

From about the middle of September when the cones begin to turn red until about the first of November when the last ones drop their seeds the tree is a traffic-stopping spectacle. It is near the road and dozens of cars stop to see the tree — many are interested enough to inquire about it.

We are trying to cross 'Charles Dickens' with various sweet bays (*M. virginiana* and its variety *australis*) in an attempt to produce an evergreen

Fig. 9. Leaves and fruiting body of *M. grandiflora* 'Charles Dickens'

magnolia which would be hardy farther north than is the case with *M. grandiflora*. Dr. McDaniel, Dr. John Wister of Swarthmore and Mr. David G. Leach of Brookville, Pennsylvania have furnished us with pollen of various selected strains for trial. Some have produced viable seeds; many have not. Dr. McDaniel has arranged for pollen to be sent from Mexico, Guatemala, and the West Indies.

Meanwhile, Mr. Don Shadow of Tennessee Valley Nursery and I plan to graft as many seedlings as possible as well as to continue to experiment with rooting cuttings, which has to date been rather unsuccessful.

Associates' Corner

The Library Revisited

Back in the issue of the Bulletin for March, 1960, I devoted this Corner to a discussion of the rich resources of the Arboretum's Library. At that time I dwelt mostly on its tremendous coverage of world floras and the wide variety of books on gardens and gardening. Also I wondered, although I may not have said so, where there would be shelf space for a single additional volume. Many books were laid horizontally on top of others simply because there wasn't a spare inch for them to stand up.

Now, just five years later, I want to talk about the Library again. I have been haunting the place recently and have been amazed to note the many changes which have taken place. First of all, I observed that two additional rows of shelves have been built on top of the old ones; thus providing space for nearly one hundred additional lineal feet of books. Alas, this space has been almost entirely absorbed and conditions are nearly as bad as they were in 1960. This, of course, is exactly as it should be. Growth is the keynote of an arboretum and there is just as much need for a library to grow as there is for a tree.

Once, in this Corner, I explained to our Associates how the money they pay in dues is spent. I said that about half of its goes toward the publication of this Bulletin and that the remaining half is divided about equally between the purchase of plants, which all of us can enjoy, and the acquisition of books, which all of us can read.

In glancing over the recent additions to the Library I observed that the Arboretum is continuing its policy of obtaining the basic floras

of the world as they become available. The most exciting recent accession is Part I of a new Flora Europaea which, when complete, will be the first comprehensive account of the plants of that continent.

In quite a different, but equally important field, is the three-volume compilation of the Massachusetts Horticultural Society's Dictionary Catalog of its library — a work comprising more than 31,000 entries. A similar work which has just been ordered, and is daily expected to arrive, is the J. H. Barnhardt Bibliography of the botanists of the world. Each of these massive publications cost about $200.

Another policy which is being pursued is to purchase an increasing number of reprints of classical works which have long been out of print. To this category belong the Species Plantarum and Genera Plantarum of the great 18th century Swedish botanist, Linnaeus. Another is Pritzel's Thesaurus of Botanical Literature up to 1870. The University's copy of this is practically in tatters. Still others are Grisebach's monumental Flora of the British West Indian Islands (published in 1864) and Britton & Rose's four-volume treatise on the Cactaceae.

Many of the newer accessions are magnificently illustrated. The new Exotica (Edition 3) is here, of course. So are Ed Menninger's "Flowering Trees of the World", Paul Jaeger's superb "Wonderful Life of the Flowers" and Edgar Lamb's three volume treatise on "Cacti and Other Succulents". Of special interest to students of the local flora is the beautifully illustrated two volume treatment of the Wild Flowers of Pennsylvania by the late Dr. O. E. Jennings, a gift of the Buhl Foundation of Pittsburgh.

Reference has been made in an earlier number of the Bulletin to the bequest of a superb collection of rare and interesting books on Bees and Bee-keeping. These were the gift of Mrs. J. O. Enders and are particularly appropriate because the Arboretum is the home of the Langstroth Bee Garden.

Another special plant collection of which the Arboretum is justly proud is its Medicinal Garden, made possible by the Founders Club Award of the Garden Club of America. It is therefore gratifying to report that in the last few years a great many books dealing with medicinal plants have been acquired for the Library. These include a four-volume treatise on Medicinal Plants by Bentley and Trimen (the gift of Dr. Douglas Macfarlan) and the ponderous "Medicinal and Poisonous Plants of Southern and Eastern Africa" by Watt and Breyer-Brandwijk.

After perusing the above list of tomes you may question my earlier statement about the "acquisition of books which *all* can read." Nevertheless, I assure you that in many cases the titles are more formidable than the subject-matter. At any rate, these are some of the outstanding volumes which, thanks to the affluence of our Associates, we were able to purchase as soon as they came on the market, while other libraries are sitting hopefully awaiting a generous donor.

Besides these exciting new additions there are shelves and stacks-full of books which one can hold without help and which contain an abundance of pith for the mere layman like most of us.

So don't be discouraged; come to the library and after gazing reverently upon the mighty treasures browse among the other offerings — something is bound to catch your eye.

Marion R. Rivinus

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since December, 1964:

Mrs. Duffield Ashmead, III
Mrs. Joseph R. Comly, II
Mrs. Joseph R. Comly, III
Dr. A. Orville Dahl
Dr. Walter S. Flory, Jr.
Mr. & Mrs. Paul Gorka
Mr. John B. Henkels, Jr.
Mrs. Morris H. Merritt
Mr. Kenneth M. Miller

Wilderness Areas of the Arboretum

Phoebe Crosby

In the March, 1963, issue of this Bulletin is an article by Arthur M. Shapiro on "The Butterflies of the Morris Arboretum." It includes a map of the "Ecological Divisions of Morris Arboretum and Vicinity" made in connection with his studies of butterflies. There are six areas, each of which is described as to its topography and its flora. This map is intriguing. Knowing next to nothing about butterflies I decided nevertheless to do some exploring with the map as a guide. I might at least learn more about weeds and wild flowers. (Fig. 10)

Area 1 section (a) is a field belonging to the Mount St. Joseph Academy, just across Stenton Avenue from the Arboretum. I found much of interest there. Outstanding was the star thistle, *Centaurea maculosa,* in full bloom at the end of August, 1963. I had seen it from Wissahickon Avenue as I drove by and thought it was red clover. There was some of that too, but it was *Centaurea* that made the masses of purplish color. This field is mowed twice during the summer and each time *Centaurea* reappears, though with less and less assurance.

The map shows a stream flowing through the field and emptying into the Wissahickon Creek on Arboretum grounds. Apparently it has no name so I call it the Meadow Brook. Small but free-flowing in the driest weather it is always interesting for the variety and freshness of the growth along its banks.

Also running through this field is a tributary of the brook that is not on the map. It is usually just a dry ditch. It was along this ditch, near where it goes through a culvert under Stenton Avenue, that *Galega officinalis* got its start.[1] And

[1] See Dr. Fogg's article in the Bulletin for March 1964 and Mr. John Stokes' follow-up account in the December issue.

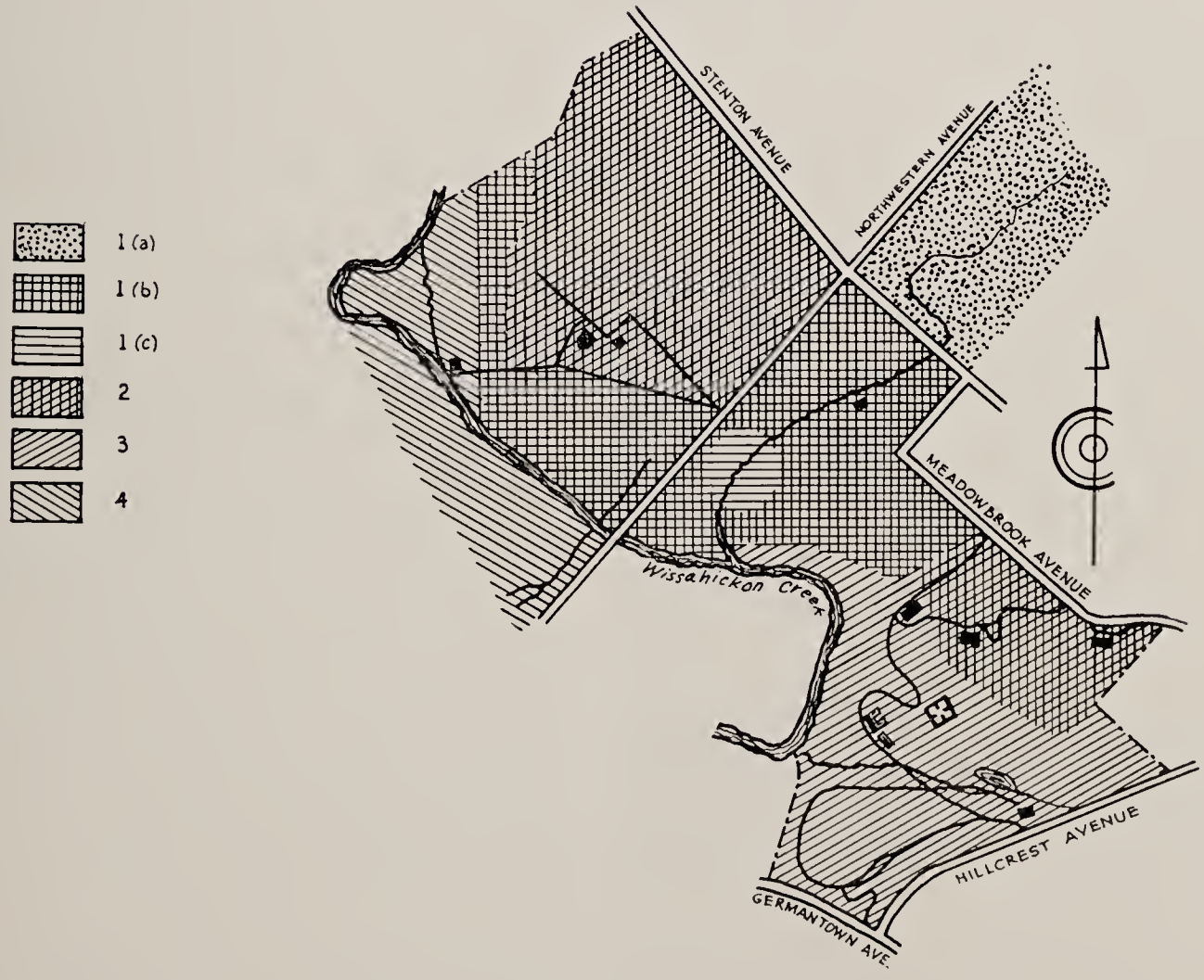


Fig. 10. Ecological Divisions of the Morris Arboretum

what a start! Within a year it has advanced upstream past the Academy buildings to a point about 500 feet from the A & P market on Bethlehem Pike, and apparently intends to keep on going. It grows 3′ to 4′ high. Its pale blue or purplish white flowers are profuse and beautiful.

To get to Section I (b) you must enter the Arboretum grounds from the Meadowbrook Avenue gate and walk down the hill to the right, close to the fence so that you will smell the pennyroyal, *Hedeoma pulegioides,* that is crushed under your feet as you go. In the meadow at the bottom of the hill you meet again the Meadow Brook which can be crossed on a plank bridge. These fields and the banks of this stream are rich in wild flowers all summer long, as well as in shrubs, such as *Amorpha fruticosa*, with its flowers in spikes of deep purple touched with orange that bear pods of rich brown in the fall.

Soon you come to a circular area I (c) which is a small cat-tail marsh, bordered by some fine trees. To see these cat-tails, *Typha latifolia,* intimately, especially in spring when the pistillate flowers are a tender green, is worth risking wet feet. On September 12, 1964, at the end of a very dry summer there was no water, but a thousand forget-me-nots, *Myosotis scorpioides,* were growing at the very feet of the cat-tails, — tall and scraggly but with a blossom or two at the end of every long stem.

Past this marshy place the brook, its banks crowded with jewelweed, milkweed, and later with asters and goldenrod, takes its way to the Creek. Here you can cross it on a sort of dam and follow the Creek itself into one of its loneliest spots, where the wooded section of Area 3 drops steeply to the edge of the water. At the foot of the cliff are caves, — holes where a fox might live. In the spring of 1952 two young foxes were seen several times by people who live on Gordon Road. Might they have followed the Meadow Brook upstream to where it flows past their backyards?

Of all Shapiro's descriptions, that of Area 4 was to me the most interesting. "A very fascinating area", he writes, "much of the original woodland remains, curiously mixed with an unusually diverse and chokingly thick adventitious growth — the entire depression being inundated frequently following heavy rains, often to a considerable depth. The soil in this basin is quite rich as a result of alluvial deposits, and the phenomenal growth of the crowded flora makes it difficult to navigate —".

I went there first on July 21, 1964. I guessed that the best way to reach it would be from that part of the Arboretum that lies north of Northwestern Avenue. I parked my car near the old mill and walked along the Creek to the golf course of the Whitemarsh Valley Country Club. Then carefully skirting the club grounds and still following the Creek, I crossed two small bridges over the two branches of the Creek. There before me was a Wilderness!

Weeds. Towering, gigantic weeds, packed so closely together and tied so tightly with thick vines that they made a formidable barrier. How to get through, how to get in?

It was an impressive sight, though. Plants that are called "pests" — Indian hemp, Japanese hop, ragweed, horse nettle, — to name only a few — that would be promptly eradicated from any well-kept garden, here, for the space of 10 acres, have it all their own way. No restrictions, no rules, — they are free to fight it out among themselves. Provided of course that they do not overstep the boundary line, and the Golf Club sees to that. There is no fence, but a cleanly kept line between perfect cultivation and no cultivation at all.

I walked along the edge of this "phenomenal growth" until I came to a way in. Not a path or a road or a trail but a fairly open space where one could see that once a cart or a wagon might have entered. Later and further along I found another, that leads across the whole area to the steep bank of Northwestern Avenue. It would be possible after all to do some exploring here.

I have been there six times, usually in early morning. In summer, unless you are hunting butterflies, that is the time to go. Get there if you can just before sunrise, while the mist lies over the low places, mallards are beginning to move slowly along the water, and golfers are still in bed. Once an American egret, whiter that the fog around her, was slowly making her way upstream, fishing as she went.

Each visit brought a special reward. There was the day I brought home an armful of the beautiful swamp milkweed, *Asclepias incarnata,* and found on one of its twigs a caterpillar that proved to be the larva of the monarch butterfly. I kept it in an old terrarium with a wire screen over it, with a supply of fresh milkweed leaves every day, until it changed into the handsome chrysalid that I had never seen before except in pictures. Two weeks later the butterfly emerged, and after exercising its wings, legs and head for two hours, took off on its first flight into the sunshine.

Then there was "wild cucumber day." I have said that these weeds have to fight each other for a space to live, and so they must. But they seem to have worked out a sort of accommoda-

tion, a way of getting along in crowds that enables them not only to survive, but, for certain ones at least, to take over the whole place for a while. On August 18, 1964, the climbing wild cucumber, *Echinocystis lobata,* was doing just that. Its white blossoms spread like a blanket over the level places, then leapt up over a bush or a stunted tree, outlining every branch and twig as if it were playing some sort of game. Three weeks later the cucumbers had subsided and one forgot them, for the early morning sunlight was on sheets of gold, — an acre of Jerusalem artichokes, *Helianthus tuberosus,* and it was a sight for the gods. That same day another golden flower *Helenium autumnale* was in blossom, equally handsome but half hidden under a bush. It is commonly, but unfairly, called "Sneezeweed."

You do not hurry through this place. And it is possible to get "lost". That is you can plunge into a thicket after a clump of Joe-Pye-weed that seems quite near and fail to get back to the trail-that-is-not-a-trail, so that (having no machete) you have to take quite a long way round to the opening-that-it-not-an-opening. And that may be the moment that an angry yellow jacket gets inside your sneaker. And if you try to hurry you may grab a stalk of stinging nettle to pull yourself up out of a gully.

But there are smooth, quiet places too, pleasant little meadows within the jungle. In one of these I found on August 2 a small fairyland of delicate pink flowers growing on branching stems two feet tall. The blossom is but a half inch wide. Its four petals stand upright at the back of the flower, giving an almost regal air to the minute thing. It proved to be *Gaura biennis* which is somewhat rare in this part of the country.

I have seen Area 4 only in a dry summer. What will it be like when the rains come? What will it be like in winter? In spring?

Out of all this have come two discoveries. One is that there is more to this Arboretum than meets the eye on a pleasant Sunday afternoon. The spring bulbs, the azaleas, the roses, have their glories and are a joy to all who come. But there are other places, less well known, more wild and secret, that are equally interesting and beautiful. It takes time, quite a lot of unhurried time, to find them, but the rewards are great. The other discovery is that you do not have to be learned, or knowledgeable, or even studious, to feel that you "belong" to this place. All you have to do is to read the Bulletin and now and then follow through on some idea that is suggested here.

Arboretum Activities

(*Continued from Page 2*)

Dr. Allison was the guest speaker on Ralph Collier's radio program, "News and Reviews" over station WFLN on December 14; her subject was the "Tree Care in the Urban Setting." She spoke on "Modern Problems in Plant Pathology" before the Community Garden Club at Wayne on January 7 and gave the same talk to the St. David's Garden Club on January 11.

Between January 3 and 8 Dr. Santamour visited universities and government laboratories in Florida, Georgia, and North Carolina in connection with his studies on the resins and resin acids of pine trees. Research conducted at the Morris Arboretum has indicated major chemical differences among pine species that appear to be related to insect resistance.

A New Map

For a very long time we have felt the need of a map which would show the exact location of the Arboretum and in particular the approaches to it by highways, roads and rail lines. Such a map has now been prepared by Mr. William B. Dowdell of the staff of our printer, the Livingston Publishing Company, and is reproduced on page 15 of this issue. Separate copies are available and may be obtained by phoning (CH7-5232) or writing to the Arboretum, Philadelphia 18, Pa.

Plant Distribution

The annual distribution of plants to our Associates will occur on Friday and Saturday, May 28 and 29. Well in advance of these dates members will receive individual announcements together with a list of the species which will be available.

Third Barnes Lecture

The third Laura L. Barnes Lecture on Botany will take place at 8 P.M. on Wednesday, April

21, in the auditorium of the Springside Upper School, Willow Grove Avenue and Cherokee Street, in Chestnut Hill. The speaker will be Dr. H. Christian Friedrich, Curator of the Nymphenburg Garden, Munich. Dr. Friedrich will give an illustrated lecture on the beautiful Nymphenburg Gardens and the branch alpine garden "Schachen." Associates of the Arboretum and their friends are cordially invited to attend.

J. M. F., Jr.

Book Reviews

Making Poisons Work for You, Not on You.

The gardener is an inquirer. He puts to nature the sort of questions whose answers might enrich his life. They are not the questions of one who starves and seeks a harvest for the winter's want. They are not the questions of the homeless seeking timber for shelter, nor are they the questions of a shepherd searching grassland for his flock. They are the inquiries of a person after beauty.

He shall see the gardens of others and note the plants that please him most. He shall winnow all the plantsmen's sayings in attending to the means of culture of the plants he prizes. But should pest or pestilence arrive, he would be in danger. The colloquy of leaf, flower, and gardener is a nice one, and the plane on which this real reward is recognized is an admirable one, yet once the urge to kill presents itself, the gardener has more than loveliness to lose.

Farmers know their crops, their troubles, and their pests. As business men, they know their men, their machines, and their advisors. They know the law, the hazards, and the safeguards. They use their prudence, skill, and discipline to produce. The gardener has himself alone as foreman. Where is his advice or discipline? Both are needed, because, unlike dangerous drugs, use of the most poisonous or hazardous agricultural chemicals is not regulated by prescription laws.

Two new sources of information have become available in recent months. One is a superb handbook for all but the most sophisticated gardeners. It is "Keep Your Garden Healthy" by Louis Pyenson, published by Dutton. The other is the third edition of what has proved itself to be one of the most useful aids, not only to skilled gardeners interested in learning a good deal about insects while controlling them, but to entomologists, extension agents and plant pathologists as well. It is Cynthia Westcott's "The Gardener's Bug Book", published by Doubleday.

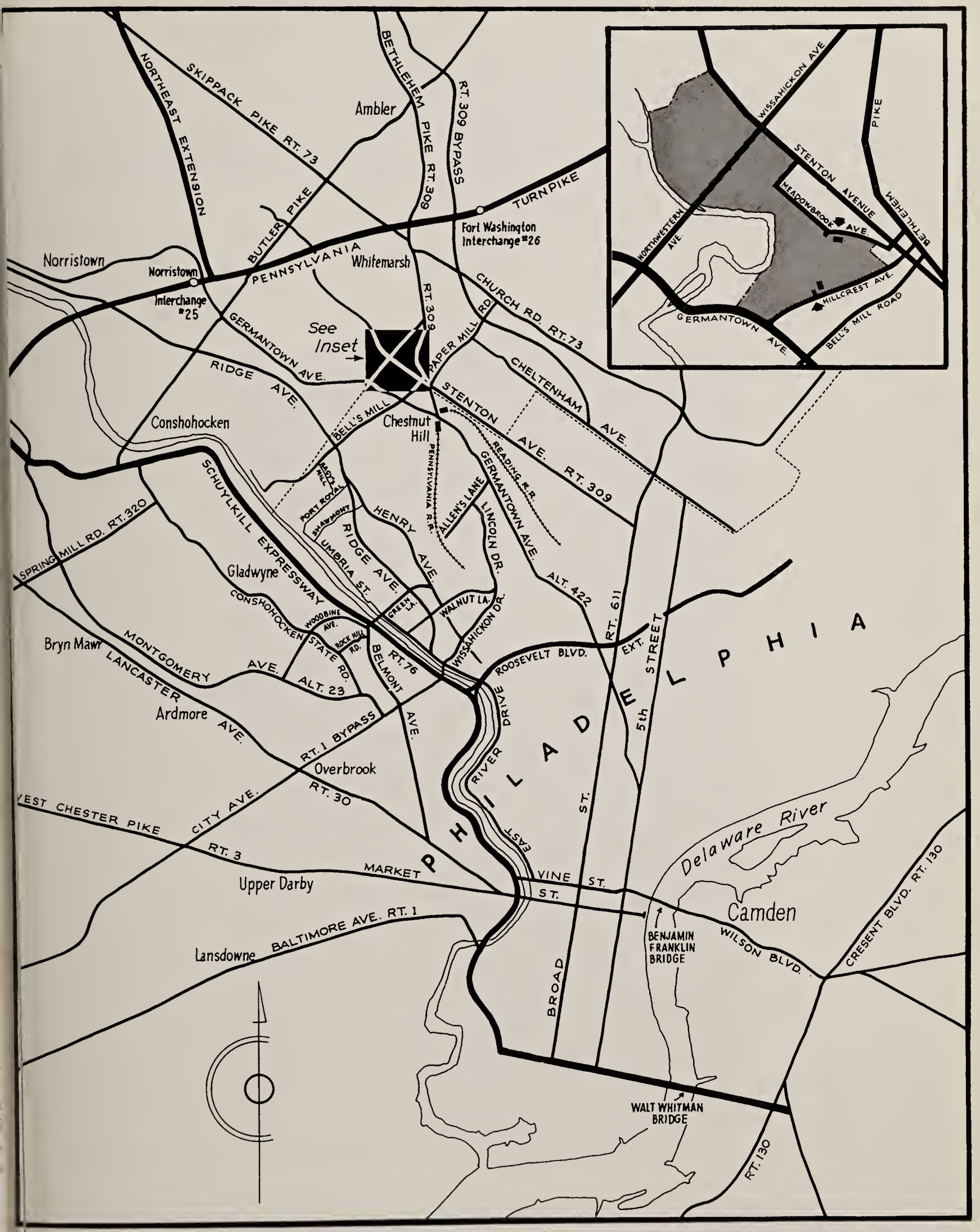
The first is a work of wide scope in which recommendations for chemical use are presented as part of the larger topic of general plant health. This presentation is extremely helpful in establishing a gardener's perspective, since he is reminded that many factors beside insects influence the health of his garden. There are chapters on plant growth and cultural practices, followed by a general consideration of trouble-makers. Dr. Pyenson includes weeds in his book. Next comes a discussion of general control methods, then separate coverages of particular components of a garden, such as the lawn, the evergreens, the shrubs, and the vegetable garden. They begin with comments about planting and nutrition, and continue with controls for the most important insects, diseases, and weed pests of the commonest plants. The separate treatment of vegetable and fruit problems is good, because it draws attention to the fact that special emphasis must be given to timing sprays far enough in advance of harvest.

Dr. Westcott's book deals in depth with specific insect pests of specific plants. Her book is a companion-piece to another, "The Plant Disease Handbook" (Van Nostrand). Together their 1450 pages represent a vade mecum consulted by scientists and gardeners alike. Some 700 host plants and almost 2000 insects are considered in the new edition.

Let us consider one all-important way the new books resemble one another. Both have revealing chapters on garden safety and pesticide toxicities that permit an intelligent interpretation of the risks involved in the use of certain chemical controls. Dr. Westcott does this by listing experimental data (toxicities to rats, better interpreted by experts), but points out frequently that some chemicals, such as dimethoate (Cygon) are better left for application by professionals. Dr. Pyenson's chapter on safety lists fungicides, insecticides, herbicides, and the like in tables clearly indicating cautions for use. A hazard rating of A, B, C, or D is assigned to each material. Those of the A and B categories include most fungicides and many other compounds such as malathion, methoxychlor, carbaryl (Sevin), Kelthane, and Tedion. Compounds of A and B types are recommended for home gardeners and custom sprayers of public areas. Compounds of C and D type are recommended for commercial growers. Among the materials designated D are Diazinon, dieldrin, dimethoate, and ethion.

Both books are highly recommended.

Patricia Allison



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Cypresses at the Generalife

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Arboretum Activities

THE STAFF

On March 12 the Director spoke to the members of the Jupiter Island Garden Club at Hobe Sound, Florida. His topic was "The Use of Plant Materials in Florida Gardens." He and his wife then flew to California where they spent a week visiting among other places, the Santa Barbara Botanical Gardens, the Huntington Gardens and the Los Angeles State and County Arboretum. From May 5 to 26, Dr. and Mrs. Fogg conducted the second Morris Arboretum European Garden Tour. An account of this trip appears in the following pages.

On May 7 a group of Public Relations officers of the Ivy League colleges met at the Arboretum. Dr. Allison gave the group an illustrated talk on "The Arboretum through the Seasons." Between May 19 and 21 she attended the Bala-Cynwyd Junior High School Science weekend at University Camp where she gave an illustrated lecture on Fungi and conducted a field trip.

(Continued on Page 28)

The Morris Arboretum Iberian Tour

John M. Fogg, Jr.

On May 5 a party of 35 persons left J. F. Kennedy Airport in New York, by regularly scheduled jet flight, for a three weeks garden tour of Portugal, Madeira, Spain and Andorra. The Director of the Morris Arboretum and his wife served as Tour Directors and the group was composed largely of Associates of the Morris Arboretum and present or former students of the Arboretum of the Barnes Foundation in Merion, Pa.

We arrived in Lisbon early in the morning of Thursday, May 6, and repaired at once to our hotel. After a leisurely morning, scheduled primarily to permit a modicum of recuperation from our nocturnal trans-Atlantic crossing, we set out by chartered motorcoach on a brief sightseeing tour of the capital. Our first stop was in the Edward VII Park, located at the northern end of the Avenida da Liberdade. (Fig. 11). This park, which was named in honor of a visit of the British monarch to Portugal, embraces a series of broad avenues embellished with statuary and planted with fine specimens of elms, lindens, horsechestnuts and maples.

In one corner of the park is the Estufa Fria or Winter Garden. Here, with only thin slats as a protection against the elements, there flourishes, among grottoes, pools and fountains, a wealth of tropical and sub-tropical plant material: palms, tree-ferns, cycads, orchids, bromeliads and representatives of such genera as *Podocarpus, Eucalyptus, Brunfelsia* and *Acanthus*. The whole impression conveyed is a combination of cool lush vegetation and brilliant flashes of color.

Fig. 11. View in Edward VII Park, Lisbon

Fig. 12. View in Lisbon Botanical Garden

After a brief look at the Museum of Coaches, we visited the Monastery of St. Jeronimo, with its incomparable cloister, and the Tower of Belem, constructed in 1515 on the banks of the Tagus to commemorate the explorations of Henry the Navigator.

Our next stop was at the Botanical Garden of the Institute of Botany of the University of Lisbon. Here the Director, Dr. Flavio de Resende, had kindly arranged for us to be met and shown around by a member of the staff, Dr. Fernando Catarino. These fine old gardens are located mainly on a declivity which permits of a system of descending walks; such an arrangement often provides a better view of the flowering portions of trees than one in which they are all grown on the same level. (Fig. 12).

Among the noteworthy conifers are splendid specimens of *Araucaria, Pinus, Cedrus, Sequoia* and *Cupressus*. The collection of Cycads is especially noteworthy. The dicotyledonous trees are represented by such genera as *Fagus, Erythrina, Diospyros, Aesculus, Ficus* and many others. There is also an impressive stand of *Washingtonia* palms. Among other features of the collection are a fine desert garden, with a interesting series of cacti and succulents, (Fig. 13), a section devoted to the various families of monocotyledons and an area allocated primarily to shrubby genera. Our interest in Lisbon's excellent garden was such that some of us returned for a second and even a third visit. Late that afternoon, on the way back to the hotel, our bus ascended a

Fig. 13. The Desert Garden at Lisbon

lofty promontory, permitting us to enjoy magnificent views of the harbor, the Castel San Jorge, and the surrounding country.

On Friday, May 7, our party left by chartered motorcoach for a two-day visit to Bussaco and Coimbra. After stopping briefly at the quaint walled town of Obidos, we arrived for lunch at the picturesque fishing village of Nazaré. The amount of film exposed here to record the fishing fleet, the oxen, the fishermen and fisherwomen, and the houses in which they live, probably represented an all-time high for any single day of our tour. The beach itself, pounded by rollers from the Atlantic, was not entirely without interest and I was pleased to observe several species of orach (*Atriplex*) as well as the European sea rocket or beach cress, *Cakile maritima,* a plant which differs from the closely related *C. edentula* of our east coast by having conspicuous processes or teeth on its fruiting bodies.

Following an excellent luncheon at the Mar Bravo seaside restaurant, we drove to El Sitio, the "upper town", on top of precipitous limestone cliffs, whence we had a superb view of the fishing village at our feet.

Fig. 14. Formal garden at Bussaco Palace Hotel

Bussaco

The road from Nazaré to Bussaco led past Leiria, with its 12th century castle, and through the magnificent woods known as the King's Pine Forest, with trees said to be seven centuries old. We passed by Pombal and stopped briefly at Coimbra for refreshments. From Coimbra to Bussaco the highway climbed steadily and led us finally into one of the most beautifully forested areas in Portugal or, indeed, in all of Europe. At the foot of the mountain, before beginning the ascent to our hotel, we paused briefly to admire the gigantic trees and lush undergrowth. Here were specimens of *Cupressus lusitanica* with trunks nearly three feet in diameter at the base, and lofty examples of the cluster pine, *Pinus Pinaster.* Mixed with these native species were *Picea Smithiana,* a native of the Himalayas, and our own American red ash, *Fraxinus pennsylvanica.* On the forest floor were

Fig. 15. View in the Coimbra Botanical Garden

such characteristic European herbaceous species as the hart's tongue fern (*Phyllitis Scolopendrium*), *Polypodium vulgare, Arum maculatum, Polygonatum officinale,* and *Geranium Robertianum.*

The Palace Hotel, which was constructed near the turn of the century as a royal residence, stands at an altitude of about 1200 feet near the summit of this densely wooded "mountain". It is a sumptuous edifice, like something out of a fairy tale, with turrets, battlements and elaborate ornaments carved out of the native schistose rock.

A group of eight or ten hardy souls met on the terrace at 6:30 the morning following our arrival and for nearly two hours wandered along the trails which seem to wind endlessly throughout the forest. Here, again, mingled with the native pines, ashes, maples and lindens, was an interesting variety of exotic species. We noted,

Fig. 16. Gardens at the Queluz Palace

for example, fine specimens of western red cedar (*Thuja plicata*), Monterey cypress (*Cupressus macrocarpa*) and Monterey Pine (*Pinus radiata*), all from Western North America; *Cephalotaxus drupacea,* indigenous to Japan, and *Taxodium distichum* a native of our southeastern states. The presence here of so many foreign plants doubtless derives from instructions long ago given to sea captains to turn over to the monks in the Bussaco Monastery seeds of every new kind of tree found on their voyages.

Close to the hotel was an enormous tree of *Araucaria Bidwillii* and adjoining the building were several handsome formal gardens, one of which is shown here. (Fig. 14).

Leaving Bussaco shortly after breakfast, we proceeded by a different route back to Coimbra. Once we emerged from the forest, our way led through an undulating terrain of open ground.

Fig. 17. *Magnolia grandiflora* at Queluz Palace

The native vegetation here was tantalizing, but the winding road was too narrow to permit the bus to stop. Suddenly we found our progress halted by a truck which had broken down, so everyone scrambled out of the bus to collect. I had been puzzled by two species of heaths, one with pink flowers the other with white, which we had been seeing. On close inspection these now proved to be *Erica umbellata* and *E. arborea.* I also collected several of the ubiquitous yellow flowered brooms which I was unable to identify at the time. The common Myrtle (*Myrtus communis*) was everywhere as were at least two species of rock-rose or *Cistus.*

Late in the forenoon we arrived at the famous Botanical Garden of the University of Coimbra, where we were graciously received by the Director, Dr. Abilio Fernandes, and members of his staff. This garden, founded in 1772, is the oldest

Fig. 18. *Araucaria Bidwillii* at Monserrate

and largest in Portugal. Like its counterpart in Lisbon, it is largely laid out on a hillside, with a series of descending walks and terraces. (Fig. 15). A fine series of greenhouses is occupied by representative collections of tropical, sub-tropical, aquatic and succulent plants. The outdoor plantings are characterized by a fine avenue of lindens and a great variety of trees, including eucalyptus, camphor, palms, araucarias and many others. The garden merits a much longer visit than time permitted us to devote to it.

Following lunch we paid our respects to the ancient University City, with its incomparable library and handsome auditorium. On our return from Coimbra to Lisbon we made a brief stop at Batalha to see its 14th and 15th century cathedral, monastery and unfinished chapel.

Sintra

Sunday, May 9, was devoted to the area around Sintra. On this occasion it was our great good fortune to have with us Dr. Joao do Amaral Franco, Professor of Botany at the Instituto

Fig. 19. Section of the garden at Reid's Hotel, Madeira

Superior de Agronomia in Lisbon. Dr. Franco's knowledge of the native vegetation and his familiarity with the large number of exotic plants cultivated in this part of Portugal contributed immeasurably to our enjoyment of the day's excursion. En route he pointed out to us many of the characteristic plants of the countryside through which we were passing. According to him, the entire area had been heavily wooded until about 80 years ago. The destruction of the original forests has produced a diversified scrub growth made up largely of yellow flowered brooms or woody members of the Legume Family. Dr. Franco cleared up the confusion which had plagued us the day before with respect to the classification of these plants. He pointed out the Spanish broom, (*Spartium junceum*), two species of retama (*Genista monosperma* and *G. sphaerocarpa*), and the low-growing *Ononis racemosa*. He also set us straight on the three species of pines which we saw during the course of the day, namely, *P. Pinea, P. Pinaster* and *P. halapensis*. It is admittedly difficult from a fast-moving vehicle to count the number of needles in a bundle or to note the character of the cone-scales. It was therefore gratifying to have with us someone sufficiently familiar with the habit of these species to be able to name them at sight.

Portugal is said to be the world's greatest producer of cork which is obtained from the cork oak (*Quercus Suber*). Although most of the large plantations are found in the far south, we saw a considerable number of these trees within a few miles of Lisbon.

Our first full stop was at the 18th century Queluz National Palace, where we spent a short time inspecting its beautifully furnished interior, including the great Throne Room. The Palace Gardens are laid out in the grand manner with broad avenues, stately rows of trees and formal beds. (Fig. 16). In the last named, the use of various species of *Lampranthus* was particularly effective. We had been seeing *Araucaria* everywhere in parks and gardens (especially *excelsa, araucana* and *Bidwillii*) but here for the first time was *A. columnaris* (*Cookii*). Fine specimens of the tree laurel (*Laurus nobilis*) abounded and the presence of *Schinus terebinthifolius* served to remind us that although our latitude was about that of Philadelphia the plants which were hardy here were those we might expect to find in northern Florida.

I once expressed the opinion in the pages of this Bulletin that *Magnolia grandiflora* was the most widely cultivated tree in the world. I had in mind, of course, only the temperate areas, for if one were to include the tropical and subtropical regions then certainly the coconut (*Cocos nucifera*) and the date palm (*Phoenix dactylifera*) would be strong contenders for this distinction. In saying what I did, however, about our beautiful American Bull Bay, I fully expected that other rivals would be brought forward. Either nobody read my statement or, if it did receive attention, no one felt impelled to contradict it. However that may be, I had not before seen it growing in Portugal. The picture reproduced here (Fig. 17) is one of several fine specimens in the gardens adjoining the Palace.

From Queluz we drove to Sintra where we had luncheon in the magnificent Seteais Palace Hotel. The grounds of this hotel in themselves constitute a botanical garden of considerable beauty and interest. One of the plants which intrigued us most was an African Aloe (*Aloe plicatilis*). The view across the country-side from the rear terrace of the hotel is one of surpassing loveliness.

Not far from here is the Monserrate park which was laid out in the 19th century by an Englishman, Francis Cook. This garden, which covers about 75 acres, occupies a steep slope with wooded ridges and deep valleys and comprises an

Fig. 20. The Main Street in Funchal, Madeira

Fig. 21. *Spartium junceum* near Malaga

incredible variety of warm temperate and subtropical trees and shrubs. A hastily compiled and very fragmentary list includes two genera of tree-ferns (*Alsophila* and *Dicksonia*), *Dacrydium, Podocarpus* spp., *Agathis, Gunnera, Drimys Winteri, Cordyline, Hedychium,* and *Diosma.* (Fig. 18).

Our final stop of the day was at Pena Palace where we had time merely for a short walk through the 400 acre park which is replete with fountains, ponds and waterfalls under a canopy of venerable trees. Several of the party returned the following day for a visit of the Palace.

The following morning was one of leisure, utilized by some for shopping and by others for a return visit to the Botanical Garden. After lunch our entire group boarded a plane for the two hour flight to the island of Madeira, arriving at Reid's Hotel in Funchal, the capitol, in late afternoon.

Madeira

Long known, and with just cause, as the Pearl of the Atlantic, this volcanic island, some 30 miles long and 12 miles wide, is situated about 350 miles due west of Morocco. Its central mountain range reaches up to 6000 feet and from it gorges and ravines descend toward both coasts. This rugged terrain creates a diversity of topography which finds expression in an endless series of terraced vineyards and gardens. Here are grown the grapes from which the famous wines of Madeira are brewed, and here are cultivated sugar cane, bananas and a host of other tropical fruits, including loquat, custard apple and mango. The island is a veritable mecca for the botanist both because of its native and its introduced vegetation. First a word about the former.

Although much of the original vegetation of Madeira has been destroyed, enough remains to indicate that it was an admixture of southern European species and those from the West Indies and tropical America. Much has been written about the preponderance of members of the Lauraceae and related families. Whether the Dragon Tree was ever really native here seems problematical. Although there is no indigenous pine, *P. Pinaster* is widely grown as a source of firewood.

Almost our only chance to see anything of the native flora was on a short afternoon bus trip through Camara de Lobos, a picturesque fishing village, to Cabo Girao, a 2000 foot high sea cliff affording spectacular views of the curved and rocky coastline.

As for the exotic element in the vegetation of Madeira, the first thing that impresses the visitor on the drive from the airport to the capitol is the ubiquitous occurrence of two American genera: *Agave* (of the Amaryllis Family) and *Opuntia,* a cactus represented there by several species. Both of these have become so completely established on nearly every sea cliff, dry slope and roadside bank as to appear throughly native.

If the botanically minded traveler did nothing more than confine his activities to the gardens surrounding Reid's Hotel he would nonetheless find himself in a kind of paradise (Fig. 19). Here in an area of relatively few acres is such a tremendous wealth of tropical and subtropical plant material as to stagger the imagination.

Of the lengthy list of species which we recorded, and many of us photographed here, space permits mention of only a few of the more unusual or interesting:

Aloe plicatilis; the same species we had seen at Sintra.

Fig. 22. Public Garden in Malaga

Fig. 23. The Rosaleda in Madrid

Dracaena Draco; the Dragon Tree, believed to have originated in the Canary Islands, but possibly at one time native in Madeira.

Grevillea robusta; Australian Oak, not an oak but an attractive orange-flowered member of the Proteaceae.

Schotia brachypetala; a bright red-flowered leguminous shrub.

Polygala myrtifolia; a shrubby milkwort with attractive lavender flowers.

Chorisia speciosa; one of the numerous tropical members of the Silk Cotton Tree Family.

Echium venosum; an ornamental shrubby borage with bluish flowers.

Leonitis Leonurus; a brilliant orange-flowered member of the Mint Family from South Africa.

Spathodea campanulata; the brilliantly red-flowered African "Tulip Tree".

Jacaranda mimosifolia; one of the most beautiful blue-flowered trees in the world; a native of Brazil.

Lonicera Hildebrandiana; the largest flowered honeysuckle (corollas 6 to 7 inches long) from Upper Burma.

Ligularia spp; golden-flowered composites related to the genus *Senecio.*

Although the garden at Reid's represents a great concentration of plant species, beauty and variety are not confined to it alone. Nearly every private garden is a riot of color. The main street of Funchal lined with a double row of jacarandas is an unalloyed delight and bougainvilleas, flame vines, hibiscus, allamandas and bright-colored bignonias and thunbergias may be seen on all sides. (Fig. 20).

The Municipal Park near the center of town, is worthy of a lengthy visit. Here we saw that (to a North American) amazing arboreal relative of our pokeweed, *Phytolacca dioica,* from South America. Here was the Sausage Tree, *Kigelia pinnata,* and here also were specimens of that protean Sterculiaceous genus, *Brachychiton,* and many another interesting plant.

Some miles from the capital and located on a steep slope (how the Portugese do love to plant their gardens on a hillside) is the Quinta Reid, established, we were told, by former owners of the hotel. Our all-too-brief stop here served mainly to convince us that we must one day go back. All in all, this tiny island in the Atlantic won the affections of all of us and we left it with deep feelings of regret.

On Thursday morning, after two idyllic days, we left Madeira to return to Lisbon. The free afternoon in the capital was employed in a variety of ways. Some of us returned to the Botanical Garden and later drove to the Castel San Jorge for its wonderful views of the harbor and the city.

Due to a variety of logistic complications, Friday, May 14, was devoted largely to travel. Since the trip by motorcoach from Lisbon to Seville was adjudged to be a little too rugged, the alternative was to fly first to Madrid, thence by a second plane to Seville. Although this was a little bit like going from San Francisco to Los Angeles by way of Denver, it was not entirely without its advantages. In the first place it permitted the entire party to have a real Spanish luncheon (gaspacho, paella and fresas) at La Barraca Restaurant, a picturesque "cueva" or cave below the level of the street. Then, since no single flight could accommodate all of us, it was necessary to divide the group into two sections, one leaving Madrid at 4 P.M., the other at 7 P.M. This meant that those who took the first flight had an opportunity to see something of Seville before dinner and that the members of the later contingent were able to spend a couple of hours in the Prado before plane time.

Fig. 24. View from summit of Sierra Guadarrama

Fig. 25. *Lagerstroemia indica* in the Madrid Botanical Garden

Seville

Seville, the capital of Andalusia, holds many attractions for the visitor, whether his interests be architectural, historical, sociological, or botanical. Two of its major structures are, of course, the Alcázar, constructed in the fourteenth century on the site of the residence of the sultans, and the Cathedral, said to be the largest Gothic edifice of its kind in Europe.

The Alcázar with its elaborate architecture served as an elegant preview of the Alhambra which we were later to visit. It is partially surrounded by a fascinating garden in which subtropical genera such as *Allamanda, Cordyline* and *Bougainvillea* vie with a rich profusion of warm temperate trees, shrubs and vines. We were fortunate in visiting the palace at a time when a fine collection of tapestries based on designs by Goya was on exhibit.

The Cathedral, with its superb tower, La Giralda, and fine orangerie next claimed our attention and following this we roamed through the narrow streets of the Santa Cruz quarter with its numerous courtyards and white houses made colorful by flowered balconies and window boxes.

Late in the afternoon a party of us walked along the Gualadquivir River past the Golden Tower (El Torre del Oro), to the extensive and beautifully maintained Maria Luisa Park. Although in no strict sense a botanical garden, this spacious area with its long avenues of trees, attractive beds of annuals and perennials, and varied plantings of unusual shrubs, has much of interest for the botanist and horticulturist.

Early on Sunday, May 16, our group departed by public bus for Granada, a ride of some four hours. Our route took us first across a rich agricultural region, then over the Sierra de Yeguas, with some spectacular mountain scenery, later through the prosperous village of Antequera and, by noon, into Granada, lying at the foot of the still snow-capped Sierra Nevadas.

After a visit to the Capilla Real, where Ferdinand and Isabella are buried, we spent the rest of the afternoon in the Alhambra and its adjacent garden paradise, the Generalife. The 14th century Palace and Gardens of the Generalife, occasionally referred to as the Gardens of Alif (the architect), was the summer retreat of the Moorish rulers. Today it is one of Spain's foremost tourist attractions and since we were there on a Sunday — a free-day — we found it difficult to see the gardens for the crowd.

The following morning, Monday the 17th, a group of us paid a return visit to the Generalife. This time we had the place pretty much to ourselves and were able to wander in a leisurely manner throughout the lower gardens which had been closed the day before. The great wealth of plant material, the tall, well clipped hedges, the handsome cypresses, said to date from the 18th century, and the general setting and architectural elegance combine to make these gardens one of the greatest beauty spots in Europe. (Cover).

Malaga

After lunch our party left by motorcoach for Malaga. This ride of about four hours across the sierras produced some of the most magnificent scenery of our entire tour. It also produced some of our greatest frustrations, since it was impossible to stop the bus to look at some of the fascinating roadside plants that puzzled us. The result was that the following morning some of us hired a car and drove back over some of the mountain passes through which we had come the day before, climbing up to the Fuente de la Reina. We were thus able to solve most of our problems: a delicate bushy plant with tiny translucent flowers proved to be *Rumex scutatus,* an evergreen shrub was identified later as *Thymelaea hirsuta* and a third kind of "retama" as *Genista*

Fig. 26. View of the valley below Encamp, Andorra

retamoides, which, our driver told us, is used to create an intense flame in the baking of bread. (Fig. 21).

Malaga has a fine public park and a fascinating terraced garden where we had spent a pleasant hour before re-ascending our mountain. (Fig. 22). That afternoon, following a visit to Torremolinos, we flew from Malaga to Madrid.

Madrid

Our first full day in Madrid (Wednesday, May 19) was one of sightseeing, starting with a visit to the Puerta del Sol, the Plaza Major, and the Royal Palace. In the West Park we stopped to visit the Rosaleda, a fascinating changing exhibit of roses held every year with plants contributed by various foreign countries as well as those of domestic origin. The collection covers an area of several acres and the roses are well grown and displayed in a most attractive setting. (Fig. 23).

We then left for the Escorial (that enormous monastery, palace and royal mausoleum) situated in hilly wooded country some 30 miles northwest of Madrid. It has been said that only 5% of Spain is still forested and that of this area about one third is in pine-land. The Escorial and the sumptuous Filpe II Hotel, where we had lunch, is located in one of these spots and the woods are very impressive. Later in the day, as we drove toward the Valley of the Fallen, we traversed an undulating countryside where only a few trees were left. Over much of this region however, the ground was a solid mass of rich purple color, due to the presence of a carpet of a beautiful lavender (*Lavandula pedunculata*).

On Thursday, May 20, our group split into two sections, about two-thirds of our members going to Toledo, while the rest of us, who were familiar with that superb city, elected to spend the day visiting Avila, Segovia and La Granja.

Our road to Avila took us over the Sierra de Guadarrama. From the pass over these mountains, where we made a brief stop, we were able to observe a pronounced change in the vegetation. *Pinus Pinea* and *P. Pinaster* were now replaced by Scot's Pine, *P. sylvestris,* here close to the southernmost limit of its European distribution. Various species of golden yellow broom (*Genista* and *Spartium*) made a lively color pattern in the clearings, interspersed with the same lavender we had seen the day before. (Fig. 24). Off to the southwest we could see the snow-tipped summits of the Sierra de Gredos, which we had observed from the plane on our flight from Lisbon to Madrid some days earlier.

Avila, a picturesque walled town founded by the Romans, was of strategic importance during the long wars between the Christians and the Moors. Its towers and battlements still occupy a commanding site on the passage through the mountains of central Spain.

After an hour or so of taking pictures and examining the native vegetation on the outer ramparts, we drove on to Segovia, arriving in time for luncheon at the famous Mesón Candido in the shadow of the Roman aqueduct. This towering structure built nearly 2000 years ago, still supplies the city of Segovia with water. Two of the greatest attractions in Segovia are the Cathedral and the Alcázar. Since we had time for only one we chose the latter and all of us climbed laboriously up the narrow dark spiral stairs to its lofty ramparts for its commanding views over the city and across the country-side.

On the way back to Madrid we went by way of La Granja, the former summer palace of royalty, and enjoyed its fabulous fountain display which takes place late in the afternoon. The gardens here are reminiscent of those of Versailles.

Our final day in Madrid was one of leisure. Many of the party went shopping or visited the Prado or both. Some of us, after an hour or so in the Prado, repaired to the Botanical Garden which adjoins the museum. Here the Director, Dr. Francisco Bellot Rodriguez, had written me to say that he would place the facilities of his institution at our disposal. Although he was engaged in conducting an examination, he arranged for several of his assistants to show us the library, herbarium, greenhouses and outdoor collections.

The Botanical Garden of Madrid was founded in 1755 (ante-dating the Royal Gardens at Kew by several years) and boasts many fine specimens of maples, elms, hackberries and ashes, some of which are believed to date back to the 18th century. Indeed, so massive and closely placed are these trees that it is extremely difficult to take pictures within the garden. The sole view shown here is of a fine specimen of crape myrtle (*Lagerstroemia indica*) near the entrance to the garden. (Fig. 25).

Thanks to a very early plane departure on Saturday the 22nd, we were able to reach Barcelona by 9 A.M. Here we transferred at once to a motorcoach for the trip to Andorra. After stopping for lunch at Ripoll, on the banks of the turbulent Ter River, our ride to Sea de Urgel, the southern gateway to Andorra, took us over the rugged Sierra de Cadi on a steep, winding mountain road which required every ounce of skill possessed by our driver.

ANDORRA

When my wife and I visited Andorra in 1956 we were fascinated by its primitive qualities. Since, then, however it has undergone considerable growth, with a great increase in the number of shops and hotels. Fortunately, no amount of expansion can possibly obscure the great natural beauty of this little valley republic nestled among the towering Pyrenees which were still capped with snow. Although our day here was the only rainy one of the entire trip, we managed to see a good deal of the native vegetation as well as the unusual plants grown on the spacious grounds of our hotel. The mountain sides here are covered with a low scrub growth consisting largely of boxwood (*Buxus sempervirens*); myrtle (*Myrtus communis*), rock-roses (*Cistus spp.*), and heather (*Calluna vulgaris*). Almost the only trees are poplars (*P. nigra*) which thrive on the narrow banks of the mountain streams. Few countries, outside of Switzerland can boast such majestic scenery as this small republic in the heart of the Pyrenees. (Fig. 26).

Our return trip from Andorra to Barcelona, on May 24, took us by a different route with a stop for lunch at the world renowned monastery of Monserrat, perched high on a niche in a fantastic pile of jagged, grey-conglomerate peaks.

Tuesday, the 25, the last full day of the tour was spent largely in a sight-seeing tour of Barcelona, including the unique Sagrada Familia church, the fair grounds and the Spanish Village.

Fig. 27. *Phytolacca dioica* at the Miramar, Barcelona

On our way to the last-named we ascended to the Miramar with its fine formal gardens and splendid view across the city and the harbor. Here, again, we saw growing, as a shade tree, the same *Phytolocca dioica* which we had seen first in Madeira. (Fig. 27).

As a delightful climax to our tour, the entire group was entertained at a cocktail party that evening in the beautiful apartment of Dr. and Mrs. Angel Ballabriga.

On Wednesday, May 26, we entered our plane for the return trip to New York, having spent a full three weeks on a tour which had offered considerable diversity not only in scenery and botanical interest, but also in an unfolding of the pages of history and man's achievements.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since March, 1965:

Mrs. Ruth L. Ansley
Mrs. Dorothy E. Berner
Mrs. Dolores Brown
Mrs. R. George Buchanan
Mr. Clifford Burnett
Mr. Harry M. Buten
Mrs. Henry Cadwalader
Mrs. Alan Corson, Jr.
Mr. David A. Daly
Mr. J. A. Daly
Mr. Henry P. Dutton
Miss Anna Frank
Mrs. M. H. Glauberman
Mrs. George Greene
Mr. Bertrand Calvert Greer
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Mrs. Horace W. Schwarz
Miss Helen D. Stout
Mrs. Charles S. Strickler
Woodrow Wilson High School
Mrs. R. Luther Young

Arboretum Activities

(*Continued from Page 18*)

Dr. Santamour, pursuing his research in the applications of bio-chemistry to systematic botany, devoted considerable time during April and May to the flower pigments in various species of *Magnolia*.

Third Barnes Lecture

The third Laura L. Barnes lecture was held in the auditorium of the Springside Upper School on Wednesday, April 21, before an audience of about 350 persons. The speaker was Dr. H. Christian Friedrich, Curator of the Nymphenburg Botanical Garden at Munich.

Dr. Friedrich presented an illustrated talk devoted primarily to the Nymphenburg Garden, with its ornamental beds, its superb rock garden, its coniferetum, its heath gardens, its magnificent greenhouses (certainly among the best in all of Europe) and its systematic and medicinal beds.

He also described, with pictures of rare beauty, the institution's alpine garden situated above Garmisch-Partenkirken in the Bavarian Alps.

The Heath Garden

Our greatly expanded garden of heaths, heathers and related plants, mentioned previously in this section, is now beginning to assume a realistic appearance. Despite a tardy and very dry spring, the setting out of plants from nursery and cold-frame began in earnest in early May and by the end of the month hundreds of young specimens had been moved into place. Despite the fact that these plants are small, each one has an accession number in our records and it is earnestly hoped that visitors will respect the integrity of this collection.

Major credit for this project must go to Mrs. Mark F. Emerson, who has devoted many hours of time and miles of travel to accumulating the wide diversity of material now shown for the first time at the Arboretum. It is she, also, who has supervised the allocation of the individual specimens. It is to be hoped that in some future issue of the Bulletin she will favor us with a comprehensive account of this newest feature of the Arboretum's offerings.

An Entering Wedge

Just inside the Hillcrest Avenue entrance, and lying between the upper and lower roadways, is a narrow wedge-shaped strip about 100 feet long and 25 feet wide at its far end. We have long pondered the problem as to just how to treat this triangle, for we wanted it to hold plants of considerable interest and yet not to break the view of the fine trio of Lawson cypresses and other conifers which stand just behind it.

Last Autumn we took the plunge, for better or for worse, and the triangle is now occupied by five different members of the Rosaceae or Rose Family. At the very tip of the wedge, nearest to the gate are a dozen small plants of *Cotoneaster Dammeri*. This is a low, prostrate species which will never attain a height of more than a few inches. Just behind these are twelve plants of *Spiraea bullata,* a dwarf spiraea with attractive rose-colored flowers. Next in order are a dozen plants of *Spiraea alpina,* a low shrub with yellowish-white flowers. These are followed by twenty plants of *Spiraea nipponica* 'Snow Mound', a slightly taller plant with pure white flowers. Bringing up the rear, at the base of the triangle, are eight plants of shrubby cinquefoil (*Potentilla fruticosa*). These, though seldom more than three or four feet high, are the tallest of the lot, and have been selected to show a range of flower color from dark yellow through creamy-yellow to almost pure white.

The entire collection, then, "climbs" from the nearly ground-level cotoneaster at the front to the more substantial cinquefoil at the back. It is hoped that as it matures, this little planting will provide an interesting and colorful entrance to that portion of the grounds.

An Associate Reports

For about a quarter of a century the Arboretum has been giving rare or unusual plants to its Associates as one of their privileges of membership. From time to time you have kept us informed as to the fate of these plants, often merely to report that they have continued to thrive, in a few cases to record their demise. Never, in our recollection, has any Associate taken the trouble to send us the kind of letter we received last month from Mrs. Lawrence Jewett of Newtown Square, Pa. So impressed were we with Mrs. Jewett's letter that we have requested and received permission to reproduce it in full here:

"I thought you might be interested in what happened to all of the plants that you so generously give away to members of the Morris Arboretum on Plant Distribution Day each year.

"I became an associate member in 1958 and received a *Cotoneaster horizontalis* which did not survive the winter.

"1959 — I selected an *Aucuba japonica* which is growing very nicely. I also was given an *Evodia* in a four inch pot which has grown into quite a large tree. Last summer it was just about as dead as any tree could be. On close inspection we discovered it riddled by the shot-gun borer. Spraying, feeding, and plenty of water revived it. Here is a $64. question — In 1963 it bloomed on the east side of the tree. Last summer after we revived it, it bloomed only on the west side of the tree. How come? ? ?

"1960 — I came home with a *Magnolia grandiflora* and a *Metasequoia*. The Metasequoia was about 24 inches high — it is now about 15 feet high (maybe more, my boy scout is not present to measure) but it seems very happy — so does the *Magnolia*.

"1961 — My selection was a *Stranvaesia Davidiana* and a *Chionanthus retusus serrulatus* — both have grown at a tremendous rate and the *Chionanthus* is loaded with flower buds for the third year — very handsome.

"1962 — A *Ginkgo biloba* and a *Fontanesia Fortunei* joined the Jewett family. Both are doing well. The *Fontanesia Fortunei* bloomed in 1964 and this year it will be covered with a profusion of flowers.

"1963 — a baby *Syringa* (Persian lilac) and a *Buddleia alternifolia* were the new additions and both are growing very nicely, but are still just youngsters.

"1964 — I selected a *Juniperus chinensis varigata* for the rock garden, and a *Hypericum Androsaenm*. You also had a large collection of Paulownias which no one seemed to want — there is nothing like being an unwanted wall-flower tree — so (with permission) I came home with three Paulownias — *Fargesi, lilacina,* and *tomentosa.*

"Except for the *Cotoneaster,* all of my Morris Arboretum children are thriving and growing like mad. The Paulownias lost their identification labels so I will have to key them out and label them with their proper names.

"In other words — the Jewett Arboretum is thriving and the *Evodia* looks good this spring."

We venture to hope that from time to time other Associates will keep us informed as to the fate of the plants which they have received from the Arboretum.

J. M. F., Jr.

Associate's Corner

Another Associate Contribution

Associate dues have made it possible to have maps made, both directional as to how to get to the Arboretum, and where to go when you get there.

Have you ever tried to make a map? It takes more than meets the eye. "You can't miss it". How often have you heard that statement when you have asked directions and then find the director has forgotten a traffic light or been indefinite about a cross or side road?

The Associate maps have been culled over again and again and made as accurate as possible, as well as readable, only to have some helpful Henry remark AFTER they were printed, "Why did you leave out so and so?" Fortunately, so far, the omissions called to our attention have been very minor.

One omission, however, in the directional map which appeared in the issue for March, 1965, is nothing short of fantastic. Despite the fact that the proof for this map had been examined many times by every member of the staff, when the map came out it was discovered that no one had put in Philadelphia's International Airport!

We are particularly proud of the handy folder depicting the actual grounds and plantings of the Arboretum which also contains a short summary of the history, objects, and offerings. Whether you are a chronic haunter of the Arboretum or merely a casual visitor who wants to take a stroll in lovely surroundings, take one of these folders along. It may call to your attention something you would not otherwise notice, thereby enhancing your pleasure.

Either map may be obtained in the Gates Building. The Associates do not consume time having meetings, they just DO things.

Marion W. Rivinus

Area Four : Spring Report

Phoebe Crosby[1]

May 5 is cool, with dark clouds and a light drizzle. Area Four looks wintry. Last year's herbaceous growth is down, and woody stems are brown and bare. Reeds that were nine feet high last summer lie on the ground, flattened out like a defeated army. A winter flood has swept over the lowest part of the area, leaving its rubbish wrapped like great shawls around any bushes that stood in its way. To look under one of these shawls is to look into a cave, dark and mysterious.

Amorpha fruticosa, that handsome moisture-loving shrub, dominates the scene. From a distance it looks brown and bare, but closer, a tinge of pink shows in the opening buds. *Amorpha* is on the move.

Underfoot, a month ago there was only a hint of life — perhaps a tiny chickweed — but now the green tide is fast rising. Acres of grass and sedge are a foot or more high, especially in the flood channel. Unsightly banks of earth are being rapidly covered over with clumps of nettle, dock, and field mustard. The race is on. Each day determines who will win out in this spot or that.

In the cultivated parts of the Arboretum, the masses of daffodils have come and gone, cherry blossoms have let their petals fall as a gay carpet under the trees. Here in this swampy meadow spring is slower to awaken, but growth is no less vigorous. The rich, alluvial soil has food for all who can find and hold places for themselves.

Here is a spot where the seasons meet and overlap. The wild cucumber vine, rampant over so much of the place last summer, has disappeared from an *Amorpha,* leaving one lacy skeleton of its gourd-like fruit hanging from a branch — lacy, but tough-fibered enough to survive winter's worst storms. At the foot of the bush, cucumber seedlings are three inches high showing a tendril or two. Ready to climb, ready to take over.

Many of these half-grown plants will be easy to recognize in a month, but now? Will this one turn out to be Joe-Pye-weed? Could that be wild senna? A place like this lays one's ignorance bare, at the same time offering endless opportunities for learning.

There are surprises. Half hidden under a young maple on the very brink of the Creek is a fine clump of *Mertensia virginica* in full bloom. On the other side of the stream its lovely pink and blue flowers would have been carried off by some delighted picnicker, but here they are safe. Nearby, less conspicuous but no less beautiful, hang the pale blue bells of *Polemonium reptans.*

As one looks around on this small "living wilderness" the question comes to mind: What will become of it? Will it be some day drained, filled in, built over with houses and sidewalks?

A question for an Arboretum — a close neighbor — to ponder.

[1] In this Bulletin for March, 1965 (Vol. 16: 11-13) Miss Crosby described the Wilderness Areas of the Aboretum. The present account deals more specifically with the Spring aspects of one of these, namely, Area Four, which is a nine or ten acre tract on the opposite side of the Wissahickon Creek from the old Springfield Mill and the Recreation Area. Ed.

Biochemical Taxonomy

Frank S. Santamour, Jr.

Taxonomy is that specialized division of botany that is concerned with the recognition, naming and classification of plants. It is probably the oldest botanical specialty, because it is the most practical. As a practical venture, plant taxonomy has been recognized in all primitive cultures. This "folk taxonomy" was based, at least in part, on chemistry. The taste and odor of a plant, the effects of plant ingestion on man and other animals, and the reactions of the plant to preparative procedures for food, dyestuffs, poisons, and fibers were meaningful characteristics in primitive taxonomy. However, both classical and modern taxonomy of the higher plants is almost exclusively dependent on morphological description. Walters[1] has stated that, "We stress morphology in plant taxonomy because our predecessors found it the easiest way to write and illustrate, and because by the time of Linnaeus we were so committed to it that any other way never occurred to us."

Morphological taxonomy has, over the years, provided botanists with a useful framework of nomenclatural entities upon which basic studies of physiology and genetics, and the practical aspects of agriculture could be based. Indeed, it has fostered communication among scientists from many disciplines and between scientists and laymen. However, the morphological approach to taxonomy, limited as it is to forms and structures, does not allow the solution of all taxonomic problems. Implicit in the "classification" part of the definition of taxonomy given above, is the relationship among genera, families, and other categories above the species level. It is in the pursuit of the perfect natural classification, perhaps unattainable, that taxonomists and others have turned to other fields of investigation to reinforce or revise the "accepted" system of classification.

Aids to Morphological Taxonomy

Since the time of Linnaeus, the development of new concepts, techniques, and instruments has led to the creation of new scientific disciplines which have had some impact on taxonomy. Microscopic anatomy, or internal morphology, has been helpful in the classification of woody plants and has contributed greatly to our understanding of the evolutionary development of cell and tissue types. Nuclear cytology, the study of chromosome number, structure, and behavior, has probably influenced taxonomy to a greater degree than other non-morphological studies. All members of a genus tend to have the same basic chromosome number and entire genera or families may, in addition, be of the same degree of ploidy. Exceptions to the norms, caused by hybridization, polyploidy, or aneuploidy may result in morphological peculiarities, and many such problems have been resolved by the cytologist. Relationships among plants may be judged by the ease with which they cross and produce fertile offspring, but the study of plant genetics has contributed less to taxonomy than was first anticipated. The amount of time involved and the difficulties encountered in the technique of artificial pollination have limited genetic studies to relatively few plant groups; many of them, fortunately, of economic importance. Crossability among plants, however, may not be a function of their entire evolutionarily-derived potential, and a single gene mutation may render individuals of the same species genetically incompatible even though their close relationship is beyond question. The advent of the electronic computer has created a kind of mathematical taxonomy, in which large numbers of variables may be analyzed. Because it is a recent development, the true potential of computer-based taxonomy cannot be determined. But it is safe to say that one of its important contributions will be the establishment of limits of variability of taxonomic entities. Chemical taxonomy is now in vogue and, judging from the enthusiastic reception accorded to the recent books and articles on the subject, will continue to be in the foreground of taxonomic and systematic research for many years to come.

Chemistry and Taxonomy

What has caused the recent upsurge in the application of chemistry to plant classification? Basically, the answer is that technology has finally caught up with theory and the long-dormant concepts of a chemical taxonomy may now be put to the test with relatively inexpensive equipment and simple techniques. Paper chromatography, first utilized in 1944, has now

[1] In Swain. 1963.

been applied to qualitative and quantitative analyses of a vast variety of organic compounds. Even though more elaborate and expensive equipment may be used to isolate and identify certain unknown compounds, paper chromatography will continue to be the basis of chemical taxonomy for a long time and will certainly be the first stop on the main route of a traveler into the field of biochemical taxonomy.

Is chemistry more basic than morphology? We tend to think so because we can see morphology with the naked eye (sometimes aided by a lens) while we must delve into the cell for a knowledge of plant chemistry. While both the morphological and chemical characteristics of plants are phenotypic (outward) expressions of basic genotypic differences, the differences among genes themselves are chemical. Certainly one very definite advantage of the use of chemical characters is that they lend themselves to the very exact qualitative description provided by chemical formulae and are susceptible to quantitative evaluation as well. In addition, biochemical characters tend to be influenced less by environmental factors than many morphological characters. Furthermore, since the methods of chemical research are quite independent of other techniques, they provide a fresh approach to taxonomic problems.

What chemicals are the most useful in taxonomic research? To begin with, we can exclude the so-called "chemicals of life" that are common to most living organisms, or specifically, to most higher plants. These are the chemicals that are involved with the transfer of energy or the synthesis of necessary metabolic substances. The basic chemical pathways of life arose quite some time before the origin of the higher plants and further evolution of these forms has not produced much variation on the theme of life processes. What has occurred, however, is a tendency for plants to become quite specialized in the production of various "non-essential" secondary substances. Generally, these substances can be considered as chemical and metabolic "dead ends" in that once they are produced they are seldom, if ever, broken down and re-utilized by the plant. Most frequently the secondary plant substances are considered to have no known role in plant development.

Before proceeding further, it might be well to mention the taxonomic potentialities that may be realized through the study of the nucleic acids, DNA and RNA. These compounds, far from being secondary substances, stand at the very core of life. It may well be, however, that by the time such information becomes available for botanical research, we will be standing on the threshold of a "Brave New World."

Some Examples

With the exception of serology, which deals with antigen-antibody agglutinations of sera derived from plant extracts, the objective of most chemical-taxonomic studies is to determine the exact identity of the various chemicals present in the plant. Generally such studies are limited to a particular class of compounds.

Amino acids, fatty acids, and carbohydrates are among the classes of compounds with the least potential for chemo-taxonomic work. About 20 amino acids are found in proteins and have a rather ubiquitous distribution. However, many non-protein amino acids have been found and further work with these compounds may prove of value.

Of the phenolic compounds of plants perhaps the anthocyanins, the prime pigments of red and blue flowers, are the most well known. The anthocyanins occur as glycosides, with various sugars attached to the phenolic base. The types of base (anthocyanidins) appear to have little taxonomic significance but the glycosidic (sugar) type seems to be related to systematics. Phenolic compounds of the heartwood of pines may serve to distinguish the two sub-genera and the distribution of leucoanthocyanins has also been useful in certain cases (*Iris*) below the generic level.

Another interesting group of pigments is the betacyanins, which were known as "nitrogenous anthocyanins" until less than ten years ago. Recent studies have shown they are not even related to the anthocyanins. The red betacyanins are found only in 8 families of the order Centrospermae, which includes the beet (*Beta*) as well as the Cactaceae. In fact, the placement of the cactus family in the Centrospermae had been doubted by many taxonomists until the data on betacyanins was presented. On the other hand, the Caryophyllaceae were orginally considered as belonging to the Centrospermae but were found to contain not betacyanins but anthocyanins. As a result, many taxonomists now consider the Caryophyllaceae as a separate group. It is interesting to note that anthocyanins and betacyanins do not occur together in the same plant.

The search for alkaloid-containing plants has probably consumed more time and travel than any other chemical research on plants. The alkaloids are a heterogeneous group of compounds which, by definition, need only be pharmacologically active, contain heterocyclic nitrogen, and have a basic character. Over 1000 different alkaloids are known including morphine, nicotine, and quinine. Because such widely different substances are distinguished as alkaloids, the presence or absence of alkoloids has no taxonomic significance. However, when the distribution of alkaloids of the same chemical

type is studied, the possibilities of taxonomic usefulness are increased. More information regarding the chemical affinities of various alkaloids is needed.

The terpenes, a group of compounds that are the "essence" of essential oils in many plants, have been utilized to solve taxonomic problems within *Eucalyptus, Pinus,* and *Mentha* (mint). However, even within the pines, no constant features of the terpenes were found that would differentiate between the white pines (sugenus Haploxylon) and the hard pines (subgenus Diploxylon).

Some plants liberate prussic acid (HCN) from various organs and are termed "cyanogenetic." In most instances the chemical nature of the compound responsible for the HCN production is not known, but even with these limitations some relationships among sub-families in the Rosaceae and Leguminosae may be determined. In *Taxus baccata,* some varieties are positive and some negative for cyanogenesis.

Discussion

It is unlikely that there will emerge from the vast amount of chemical information now being gathered a new phylogenetic system based on the distribution of biochemical compounds. Biochemical research, like cytology and genetics, may furnish supplementary information that, in combination with other data, may serve to clarify a given situation.

However, the advantages of the chemical analysis of plants extend beyond the possibilities of utilizing the chemical information in determining taxonomic affinities. A definitive analysis of the pigments causing flower color, for instance, enables the geneticist to evaluate more adequately the results of breeding. Chemicals involved in incompatibility or lack of crossability might be discovered, and through appropriate means be eliminated as genetic barriers. New sources might be found for chemicals that are important in pharmaceutical work or some other industrial application. Since resistance of plants to insect and disease pests may have a chemical basis, both the nature and amount of these inhibitory substances may be discovered and the information utilized in control and selection programs.

The age of chemical analysis is upon us, and we can look forward to an ever-increasing usage of chemical information by professional and amateur botanists alike.

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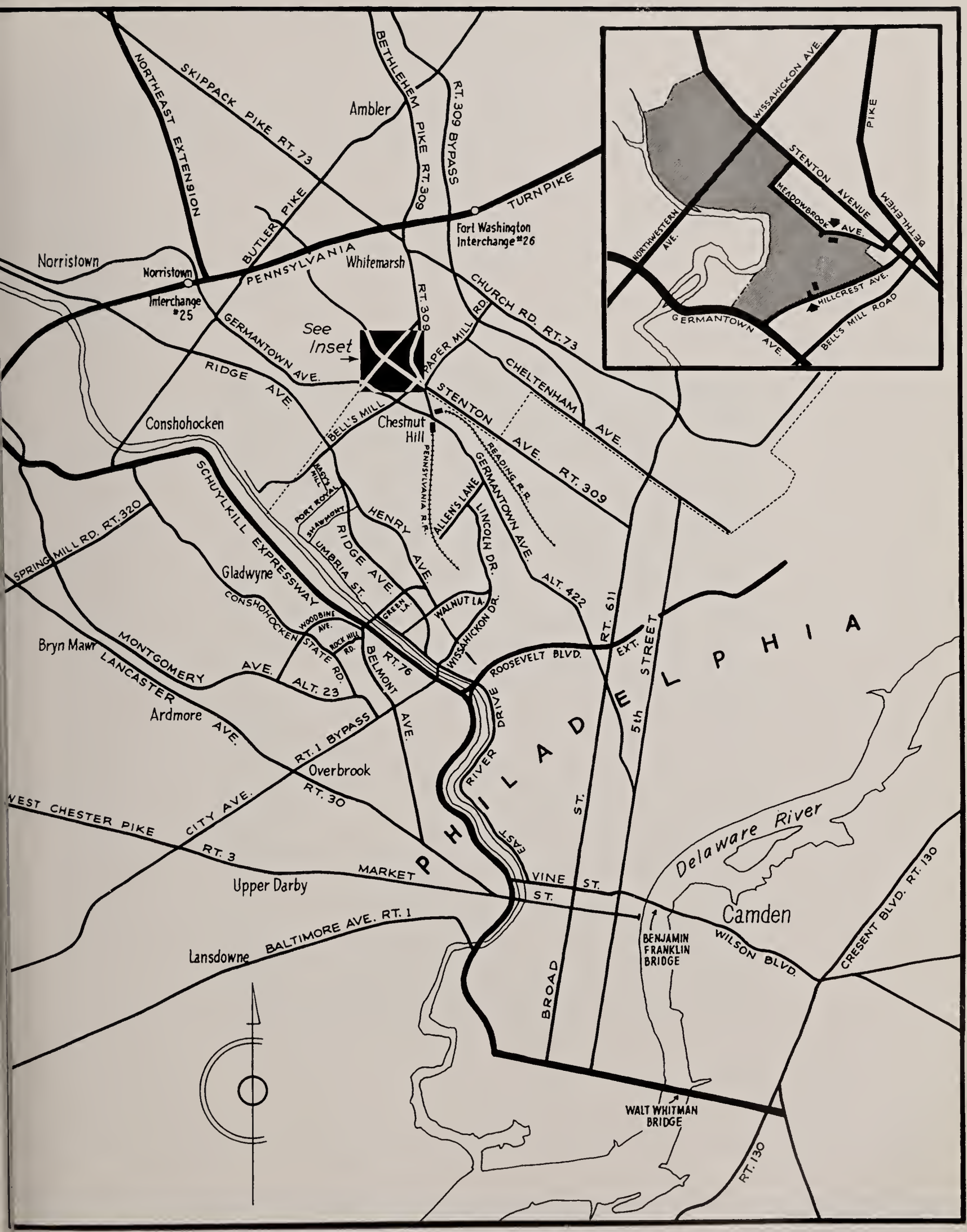

MAP SHOWING ACCESS TO THE MORRIS ARBORETUM, PHILADELPHIA, PA.

Morris Arboretum Bulletin

SEPTEMBER, 1965

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Magnolia macrophylla

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THE ASSOCIATES, through whose interest and generosity *The Bulletin* and certain other undertakings of the Arboretum are made possible, is an informal group of individuals interested in encouraging and furthering the educational and research endeavors of the Morris Arboretum.

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Contributing	$ 5.00 a year	Supporting	$ 25.00 a year
Sustaining	$10.00 a year	Sponsoring	$100.00 a year
		Donor	$500.00

Arboretum Activities

THE STAFF

Dr. Li returned at the end of July from a year's leave of absence spent in Hong Kong where he served as Chairman and helped to organize the Department of Botany in a newly established university. He has undertaken to prepare an account of his botanical experiences in Hong Kong for the next issue of the Bulletin.

Dr. Santamour spoke to the Philadelphia Chapter of the National Association of Gardeners at their June meeting. His topic was "The Chemistry and Inheritance of Flower Color."

Miss Elizabeth V. Orsatti has resigned her position as horticultural technician at the Arboretum in order to embark upon a career of teaching. She performed many important functions for us and her services will be greatly missed.

(Continued on Page 50)

A Note on Pteroceltis Tatarinowii

John M. Fogg, Jr.

For many years the Arboretum has had a tree which bore the label *Celtis Bungeana,* a native of China, Manchuria and Korea. The specimen is about 8 m. (25 ft.) tall, of low arching habit, multiple trunks and smooth light gray bark. (Fig. 28) The leaves are ovate, acuminate, palmately veined, serrate near the apex and slightly assymetrical, as is usually the case in *Celtis.* Since we had never observed it in fruit, there seemed no reason to question its generic identity, although we had frequently commented on the complete absence of witches' brooms, a feature so characteristic of many species of this genus.

Late in July, 1965, the members of my class on Woody Plant Identification were shown this tree in the course of their daily field trips around the Arboretum grounds. One of the members of the group collected a small twig and brought it back to the laboratory for pressing. My laboratory assistant, Mr. A. Edward Murray, Jr., happened to notice this fragment and called it to my attention. To our amazement it was in fruit and instead of a drupe it bore a broadly winged samara enclosing a small nutlet. We immediately recognized it as *Pteroceltis,* a monotypic genus of central China, of which *P. Tatarinowii* Maxim. is the only representative.

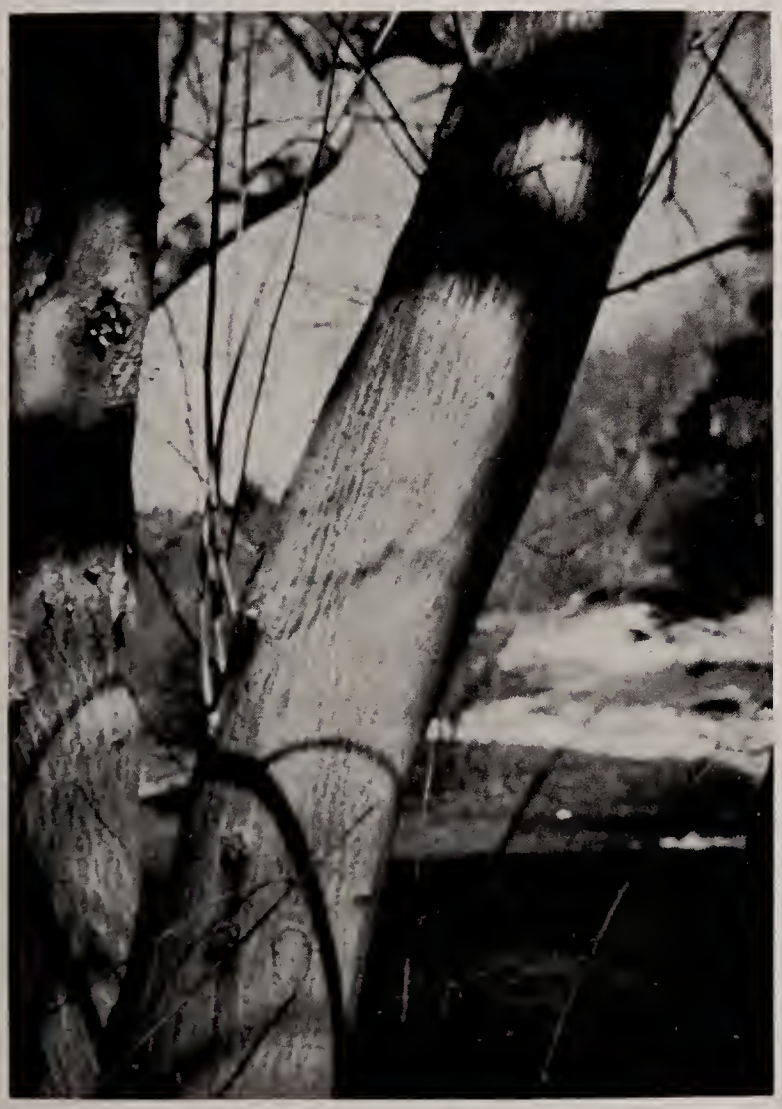

Fig. 28. Trunk of *P. Tatarinowii*

Fig. 29. Leaves and fruit of *P. Tatarinowii*

We later returned to the tree to collect additional material, but it was very sparsely fruited and the greenish to light brown samaras were almost entirely concealed by the leaves. The suborbicular or quadrate fruit is about 1.5 cm. long and 1.0 cm. wide with an emarginate apex. (Fig. 29)

Occurence in the Wild

Most of the manuals dealing with cultivated woody plants (Bean, Krüssman, Rehder, Schneider, etc.) give the range of *P. Tatarinowii* as Central or Northern China.

Dr. H. L. Li of the Arboretum staff has very kindly translated the following passage from Chen's "Illustrated Manual of Chinese Trees and Shrubs."

"Hopei, Shantung, Honan, Shensi, Kansu, Kiangsu, Anhwei, Hupeh, Szechuan, Kweichow,

Fig. 30. *P. Tatarinowii* near Wa Shan, China

etc. but rare. (This is north to east, central and west China) Generally along creeks or on rocky ground. Small forests noted in some parts of Hopei. Wood fine and hard, durable, for making furniture, farm implements, construction, etc., especially suitable for making wheel axles; its hardness is comparable to *Betula chinensis*. It is said that the bark is used for making a high grade paper."

The photographs here reproduced were taken by E. H. Wilson in China. Fig. 30 is a tree 45 feet high and 6 feet in circumference at the base which was photographed at an altitude of 2000 feet near Wa-Shan on September 21, 1908.

Fig. 31 shows a tree 50 feet in height and 15 feet in circumference growing at San-yu-tung, near I Chang and was taken on January 14, 1909. This tree shows the multiple branching which is seen in our own much smaller specimen. For permission to reproduce both of these fine photos we are indebted to the Arnold Arboretum.

Occurrence in Cultivation

According to Bean this species was introduced into France in 1894 and at the Royal Botanical Gardens at Kew in 1897. The exact date of its introduction into the United States is apparently not known, but the Arnold Arboretum received seeds from Vilmorin in France in 1920.

In an effort to ascertain to what extent the tree is cultivated in the eastern United States I have written to members of the staff of the Arnold Arboretum at Jamaica Plain, Massachusetts, the New York Botanical Garden, and the U. S. National Arobertum at Washington, D. C. The information which they have kindly supplied is here summarized.

Dr. T. R. Dudley of the Arnold Arboretum states that between 1920 and 1935 the Arboretum received and germinated five lots of seeds from a variety of wild and cultivated sources, but that none of these survived for more than a few years. Their most successful attempt was with a batch of seed received in 1935 from Dr. Sun Yat Sen Memorial Park, Nanking, China, which lived for four years. The species is not now in cultivation at the Arnold Arboretum. Since Rehder gives the limit of hardiness of the tree as Zone V with a question mark, its failure to survive there is perhaps not too surprising.

Dr. Dudley has also kindly made available copies of the two fine photographs of *Pteroceltis*, taken by E. H. Wilson in China, which are reproduced here. (Figs. 30 and 31).

Mr. T. H. Everett, Assistant Director (Horticulture) of the New York Botanical Garden, writes as follows: "In 1943 we were growing this species in our nursery, but as it was killed back in hard winters, it did not exceed the dimensions of a good sized shrub." He adds, "At that time, too, we had a plant of *Celtis Bungeana*. I am not sure whether or not that was in the nursery or in our regular collections."

Dr. F. G. Meyer, who is in charge of the herbarium at the U. S. National Arboretum, responded to my query by stating, "We do not have it now nor does Glenn Dale."

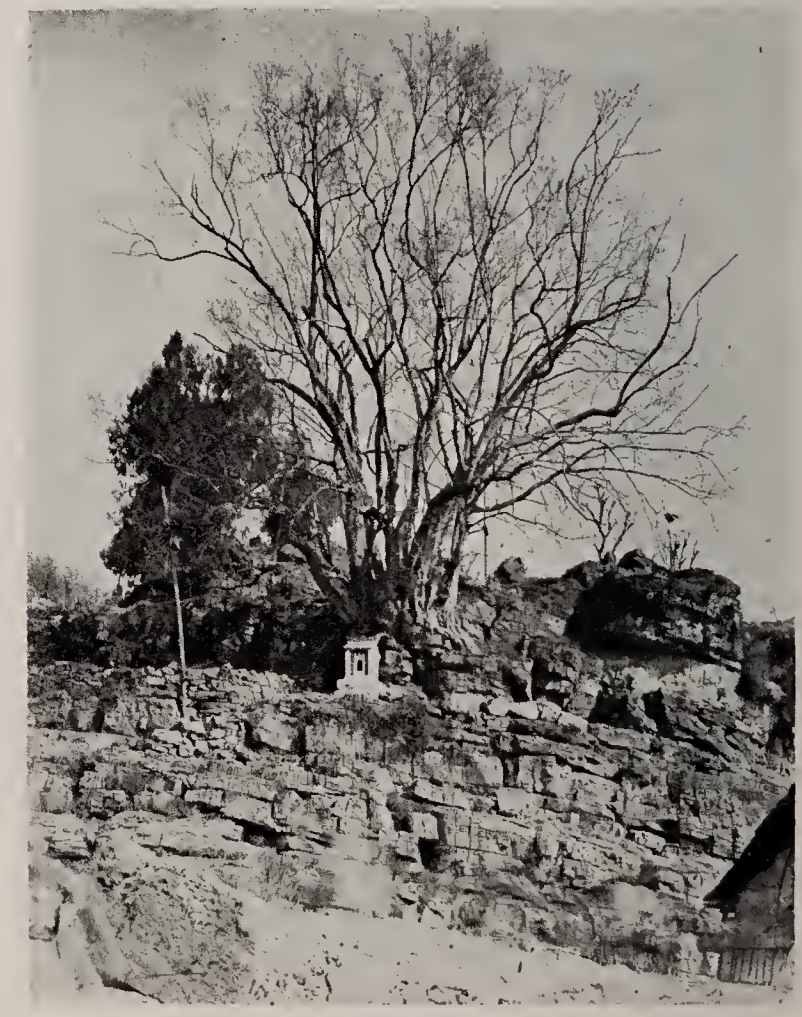

Fig. 31. *P. Tatarinowii* near I Chang, China

This is, of course, a very inadequate though highly significant, sampling of institutions which might be expected to have this species in cultivation. It is to be hoped that anyone reading this account and possessing information of its occurrence will communicate with us. To the best of our knowledge *P. Tatarinowii* is not now grown in any other botanical garden or arboretum in the Philadelphia area. It would certainly appear that this species is almost unknown in cultivation in New England or the Middle Atlantic States.

History of our Specimen

It is, unfortunately, impossible to state with any degree of accuracy just when the Morris Arboretum received its plant of *P. Tatarinowii*. Its arrival certainly antedated 1932, the year in which the University of Pennsylvania assumed responsibility for the administration of the Arboretum. Before this time records of accessions are often vague or even lacking. Our retired Superintendent, Mr. John Tonkin, who has been here since 1913, believes that the specimen was received approximately 40 years ago; this would place it in the middle 1920's.

We do know that the plant was obtained from the Bureau of Plant Introduction of the U. S. Department of Agriculture at Glenn Dale, Maryland. If the U.S.D.A. accession number 21977, which it bears, is correct then, according to Dr. Francis De Vos, Assistant Director of the U. S. National Arboretum, it was grown at Glenn Dale from seed received in 1907 collected by F. Meyer in Tuyung, Shantung, China.

Its confusion with *Celtis Bungeana* in our collection results from the fact that a plant of that species, apparently received at about the same time, bears the DA number 21972. A specimen in our herbarium, collected on March 14, 1933, which is labeled *C. Bungeana* is from the plant now correctly identified as *P. Tatarinowii*.

Pteroceltis is a very handsome tree with attractive bark and interesting foliage. Its flowers and fruit are inconspicuous, but its low, branching habit and light gray trunks make it worthy of a place in any collection of woody plants.

A herbarium specimen collected on July 19, 1965 (Fogg No. 22348) has been deposited in the herbarium of the Morris Arboretum and other sheets (Murray No. 609) have been forwarded to the Arnold Arboretum and the U. S. National Arboretum.

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Schneider, C. K. Illustrierte Handbuch der Laubholzkunde. Jena. 1906.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since June, 1965:

Mrs. Winslow Ames
Mr. Barry F. Deetz
Mrs. Leah N. Epstein
Mr. Frank D. Genetti
Mrs. Katharine Harbison
Mrs. J. Burnett Holland
Mr. Stuart W. Hughes
Mr. and Mrs. Thomas P. Loose
Mr. F. Clyde Michel
Mrs. Sheila Robinson
Mr. and Mrs. Robert W. Sample
Mr. and Mrs. Lenfred Savey
Miss Sally Schoettle
Mrs. Edna Joy Smith
Mrs. George N. J. Sommer, Jr.
Mr. Charles D. Spotts
Mr. Charles S. Tiers, Jr.
Mr. and Mrs. Gerald Tomasello

Book Review

DEADLY HARVEST, A GUIDE TO COMMON POISONOUS PLANTS, by John M. Kingsbury. 128 pp. Holt, Rinehart and Winston, Inc. $4.50

The opportunities for amateur naturalists to enlarge their enjoyment seem to be increasing day by day. Certainly there are significant efforts on the part of governments of all levels to preserve areas of natural wonder and to lessen or counteract in some way the blundering that too often accompanies "progress." But these increased opportunities are not only in the savoring of nature itself, but in the enriching of the intellect made possible by the publication of noteworthy books by individuals especially well-informed about various aspects of the natural world. Some of these have been authored by extraordinarily specialized naturalists, such as Euell Gibbons whose volumes on edible plants and animals ("Stalking the Wild Asparagus" and "Stalking the Blue-eyed Scallop") provide both useful information and entertainment. Others have been written by professional biologists who have recognized their obligation to share a part of their knowledge with an intelligent, interested "lay" public. Professor Paul B. Sears has thus shared in numerous works, not only his astonishingly broad grasp of the interlocking dependencies of members of the living world, but also his genuine concern about needless and irreversible changes being wrought by man. Professor Alexander H. Smith likewise has contributed an authoritative work in his two editions of the "Mushroom Hunter's Guide." In it he naturally endeavors to steer the gourmet reader along those paths that will allow him to lengthen his life list of species of mushrooms enjoyed rather than bring it to an abrupt close with the next-to-last entry.

To the naturalist's library may now be added a most intriguing little volume written by a recognized authority. It is "Deadly Harvest" by Professor John M. Kingsbury of Cornell University. It deserves a place among the books of those who are interested in man's economic and agricultural history as well, and it belongs among the favorite volumes of horticulturists and gardeners who derive satisfaction from learning as much as they can about the ornamental plants they cherish. It deserves space too, on the shelves of parents of small children.

There is little doubt that there will be surprises in store for many readers, for "common poisonous plants" are by no means confined to wild woodland or field, but may be encountered on farms and in city gardens, and even in neighborhood shops. Among these are sunburned potato tubers (revealed by greenish skin), poinsettia plants, rhubarb leaf blades, daphne plants, castor bean seeds, and an array of house plants. The seeds of many of our favorite fruits are poisonous. Providing a means for recognizing some of our common poisonous plants of course serves a useful purpose, but Dr. Kingbury's book does more than this. He discusses in very interesting fashion just how laboriously information about the plants, their poisonous parts, and their poisons has accumulated. Furthermore, the notion that poisoning by plants usually occurs in isolated cases is quickly dispelled. Discussions are given, for example, of poisonings of epidemic proportions. Among such disasters that have affected men, farm animals, and wild creatures are widespread outbreaks of ergotism, the killing of hundreds of grazing animals, the silent slaughter in the wild of birds and animals by certain blue-green algae, the corpse-laden tides that run red with myriad poisonous single-celled marine algae, and the strange poisoning sicknesses of human beings, transferred to them by intermediate organisms. These last include milk sickness, said to have claimed the life of Abraham Lincoln's sweetheart, who presumably drank poisonous cow's milk; and fatal poisonings caused by the ingestion of clams that were contaminated, but not harmed by certain algae.

One cannot help but be impressed anew with man's agricultural history, and the often-heard glib statement that ancient man changed from a roving animal-hunter to a home-loving plant-grower suddenly becomes personally meaningful, for it is obvious that the transition could by no means have been a simple one. It is not simple now in many parts of the world, and in our own west the saga still unfolds. Dr. Kingsbury relates the problems accompanying the transfer of grazing animals to the strange flora of a new land, and the continuing story of the fight against poisoning from Halogeton, a plant imported in the thirties from Russia.

It is regrettable that botanical names are largely omitted in "Deadly Harvest," since the author has emphasized the importance of their use. The index is thorough however, and helps connect common names with generic names. Nevertheless "Deadly Harvest" is an exceedingly interesting and helpful book. The technically minded may consult the author's slightly earlier work "Poisonous Plants of the United States and Canada" for additional details.

PATRICIA ALLISON

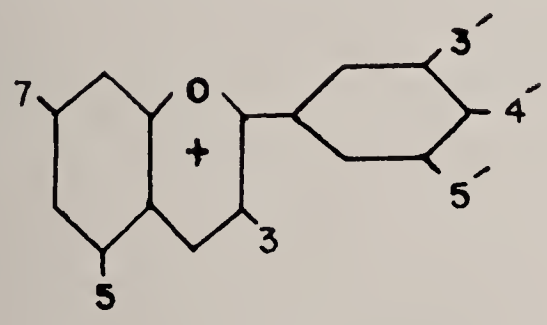
Biochemical Studies in Magnolia I. Floral Anthocyanins

Frank S. Santamour, Jr.

ABSTRACT

Cyanidin and peonidin were the only anthocyanidins found in the flowers of several *Magnolia* species and cultivars. The most prevalent glycosidic type was the 3-rhamnoglucosido-5-glucoside, although the 3, 5-diglucosides were found in mixture or alone in some plants. A trace of cyanidin-3-glucoside was found in only one cultivar.

The anthocyanins are a group of flavonoid pigments that are the basis for most of the red, purple, and blue coloration in higher plants. Chemically, they are glycosides (sugar containing), the sugar-free portions of which are termed aglycones or anthocyanidins (I). Of the 10 recognized aglycones, only six are at all common.



I. Aglycone (Flavylium ion)

The most common, and apparently the most primitive type, is cyanidin, in which hydroxyl (-OH) groups are attached to I at positions 3, 5, 7, 3′, and 4′. Replacement of the hydroxyl hydrogen atom at position 3′ with a methyl ($-CH_3$) group gives peonidin. Other aglycones are the result of various hydroxylation and methylation patterns on the basic nucleus.

Sugars are attached most commonly at positions 3 and 5, with glucose being the most prevalent sugar. Other simple sugars, such as rhamnose, as well as disaccharides and trisaccharides may also be present. The work of Harborne (1963a) and Harborne and Hall (1964) has distinguished 18 different glycosidic types, and it is likely that more will be discovered.

Some anthocyanins may also contain acyl groups (organic acids) attached to the anthocyanin through the sugar hydroxyl groups (Harborne, 1963b). Since these types are relatively rare and were not encountered in the present study, no further reference will be made to them.

In view of the recent findings and current research on plant pigments, no accurate estimate of the number of anthocyanins is possible. If an estimate were needed, "about 70" would suffice.

Each genus has a characteristic glycoside pattern (Harborne, 1963) and therefore this pattern may have taxonomic significance. In addition, as pointed out before (Santamour, 1965), knowledge of plant chemistry may contribute to a greater understanding of the results of hybridization studies and genetics research. The present study may be regarded as a first step toward elucidating the chemical nature of the genus *Magnolia,* and perhaps the entire order Magnoliales.

Literature Review

Relatively little has been reported on the anthocyanins of *Magnolia* flowers, the main reason probably being that most of the species have white petals. However, a fairly good number have colored male and female flower parts. Robinson and Robinson (1932) reported that the petals of *M. Sennei* (probably 'Lennei'), *M. Alexandrina,* and *M. Rustica rubra* appeared to contain a peonidin 3, 5-dimonoside. These types are cultivars of the hybrid *M.* × *Soulangiana* Soul. and should properly be enclosed in single quotes, as 'Lennei' above. Hayashi and Abe (1953) found both cyanidin and peonidin in *M. liliflora* Desrouss. but did not determine the glycosidic types. Forsyth and Simmonds (1954) reported on the anthocyanins of the fila-

Fig. 32. *M. stellata* 'Rosea'

Fig. 33. *M. Siebollii*

ments of *M. grandiflora* L. from Trinidad. They found a cyanidin glycoside (R_f 0.22) and a malvidin glycoside (R_f 0.26) to be the only anthocyanins present.

Identification of Anthocyanins

Paper chromatography was introduced into the study of anthocyanins by Bate-Smith (1948) and is the primary tool for most identification work. The basis for chromatographic separation is the differential mobility of different substances in various solvents. The symbol R_f is used to designate the distance traveled by a substance relative to the movement of the solvent front. Harborne (1958a) has presented R_f values for the more common anthocyanins in several solvent systems, and this work is extremely useful as a guide. However the R_f values may vary depending on the type of paper used, length of development time, concentration of the substance, distance of starting line from solvent, temperature, presence of other substances, and the method of development (generally ascending or descending). Thus, while published reports may be helpful in determining the extent of separation between substances in different solvents, each experimenter must adapt to the conditions imposed by his material and equipment.

Another useful tool for identification is absorbtion spectrophotometry. Although anthocyanins are characterized by exhibiting intense absorbtion in the 500-550 mu region of the visible spectrum, many of the differences between pigments are extremely slight. Harborne (1958b) has also presented a survey of this aspect for both aglycones and anthocyanins.

Experimental Methods

All anthocyanins were extracted from the various flower parts in cold 1% methanolic HCl. A portion of the concentrated extract was fully hydrolyzed by boiling in 2 N HCl for 40 minutes. Extraction and purification of the colored aglycone followed the procedure outlined by Geissman (1955). The material was spotted on Whatman No. 1 chromatography paper (8 x 8 inches) with the starting line 4 cm. from the edge. The paper was placed in a stainless steel tank and irrigated by the ascending technique in Forestal solvent (acetic acid-conc. HCl-water, 30: 3:10, v/v) for two hours at 22.5° C.

Commercial cyanidin and delphinidin and cyanidin and peonidin obtained by hydrolysis of *Paeonia* petals were used as controls. The R_f values of cyanidin and peonidin were 0.52 and 0.66 respectively compared with Harbone's (1958a) values of 0.49 and 0.63. Absorbtion spectra were determined with a Bausch & Lomb Spectronic '20' spectrophotometer in various solvents and with the addition of aluminum chloride (Harborne 1958b). Cyanidin and peonidin were the only aglycones found in the Magnolia flowers examined.

Two basic solvent systems were used in the chromatographic identification of the anthocyanins. These were BAW (butanol-acetic acid-water, 4: 1:5, v/v, upper phase) and 1% HCl (water-conc. HCl, 97: 3, v/v). Equipment and conditions were the same as for the aglycones, except that a development time of only 30 minutes was needed with the 1% HCl. When a

Fig. 34. *M.* × *Soulangiana* 'Alexandrina'

Fig. 35. *M. liliflora*

mixture of substances was suspected, these solvents were sometimes used in a two-dimensional separation scheme. The extract containing the unknown substances was first run in BAW, the paper was dried, and the resultant spots run at right angles in 1% HCl.

The vast majority of chromatographic work on anthocyanins has utilized descending development, but Acheson *et al* (1956) reported better separation and definition of spots with BAW by the ascending technique. This was also found to be true in the present study, where the superiority of ascending development was probably due, in part, to the short development time.

Complete acid hydrolysis of an anthocyanin results in the production of the aglycone and simple sugars. However, partial hydrolysis in HCl for various periods will yield break-down products, which may give valuable evidence bearing on the structure of an anthocyanin identified previously only on the basis of R_f values in two solvent systems. For instance, cyanidin 3-rhamno-glucosido-5-glucoside will yield cyanidin 3-rhamnoglucoside, cyanidin 5-glucoside, cyanidin 3, 5-diglucoside and cyanidin 3-glucoside as intermediate products of hydrolysis. There would be no intermediate products during the hydrolysis of cyanidin 3-glucoside.

Another chromatographic technique utilized in this study was co-chromatography. With this method, the similarity of two or more unknown substances or of a known compound and an unknown may be judged by placing both extracts or substances at the same spot and determining any separation between them on the developed chromatogram. This technique is especially useful where only small amounts of certain extracts are available; exhaustive analyses being made only on the more plentiful of two or more identical unknowns.

Methods for the determination of the sugar components were adapted from Harborne (1960a). Few control substances were available for the anthocyanin chromatograms, although the 3, 5-diglucosides of cyanidin and peonidin obtained from *Paeonia* species (Beale *et al*, 1941) were utilized.

Results

Results of the anthocyanin determinations are presented in Table I, and discussed under the appropriate species designation. The anthocyanins of colored stigmas, where present, were similar to those of the petals, and are not included in the Table.

M. stellata (Sieb. & Zucc.) Maxim.

Generally, the petals of the star magnolia are considered to lack pigmentation. However, during the spring of 1965, one specimen produced petals which were lightly suffused with pink near the base and along the mid-line for about one-half the length of the petal.

Fig. 36. *M. obovata*

Table 1. Anthocyanins of Magnolia flowers

Species and cultivar	Number	Organ	Aglycone		Glycoside		
Magnolia-			Cyanidin	Peonidin	3-rhamno-glucisodo-5-glucoside	3-5 di-glucoside	3-glucoside
stellata	M62-297	petal	+	—	+	—	—
stellata 'Rosea'	M30-3183	petal	+	—	+	—	—
		anther	+	—	+	—	—
Sieboldii	M61-545	anther	—	+	+	—	—
grandiflora 'Charles Dickens'	[1]	filament	+	+	+	—	—
grandiflora	M 600	filament	—	+	+	—	—
stellata 'Orchid'	M62-67-B	petal	+	+	+	—	—
		anther	+	+	+	—	—
tripetala	M61-553	filament	+	+	+	—	—
×*Soulangiana* 'Lennei'	M36-6553	petal	—	+	+	+	—
		anther	—	+	+	—	—
×*Soulangiana* 'Alexandrina'	M61-551	petal	—	+	+	+	—
		anther	—	+	+	+	—
liliflora	M45-96	petal	—	+	+	+	—
		anther	—	+	+	—	—
obovata	M 782	filament	—	+	+	+	—
liliflora 'Nigra'	M61-555	petal	+	+	—	+	
		anther	+	+	—	+	
liliflora 'Nigra'	[2]	petal	+	+	+	—	+[3]
		anther	+	+	+	—	—
macrophylla	M49-389	petal	+	—	—	+	—

[1]Seedling grown by Dr. Patricia Allison.
[2]Grown at the Arboretum of the Barnes Foundation, Merion, Pa.
[3]Cyanidin only.

The anthocyanin was cyanidin 3-rhamnoglucosido[1] 5-glucoside, as in *stellata* 'Rosea'.

M. stellata 'Rosea'

The petals of 'Rosea' were a strong pink and the filaments and anthers were also colored. (Fig. 32) The raw anthocyanin extract gave only one spot (R_f 0.25) in BAW and (R_f 0.40) in 1% HCl. Cyanidin was the only aglycone. Partial hydrolysis in 1N HCl gave cyanidin 5-glucoside (R_f 0.49 in BAW), cyanidin 3-5-diglucoside (0.33), cyanidin 3-rhamnoglucoside and 3-glucoside (0.37). The latter two compounds were separated in 1% HCl at 0.23 and 0.08 respectively.

M. Sieboldii K. Koch

In this species both the filaments and anthers were crimson. (Fig. 33) The only anthocyanin was peonidin 3 - rhamnoglucosido - 5 - glucoside, which gave an R_f of 0.27 in BAW and 0.40 in 1% HCl. The anthocyanin was inseparable from the lower spot of 'Lennei' and the upper spot of 'Orchid'.

M. stellata 'Orchid'

This cultivar was obtained in 1962 from Hellenmeyer's Nursery, Lexington, Kentucky, and was named by them. The petals were a rather uniform red-purple and the anthers and stigmas were also colored. Both cyanidin and peonidin were detected in the hydrolyzed extract. The raw extracts of all colored organs gave two spots in BAW at 0.30 and 0.25 and only one spot in 1% HCl at 0.42. The lower spot (BAW) was inseparable from that of 'Rosea' and the upper spot was inseparable from the anthocyanin of *M. Sieboldii*. Thus, the glycosidic type was determined as the 3-rhamnoglucosido-5-glucoside.

A quantity of the raw extract was banded and run in BAW for further purification. Following

[1] The disaccharide composed of rhamnose and glucose is called rutinose, and the glycoside is termed a rutinoside. In this paper, however, the longer name will be used for the sake of clarity.

elution of the developed bands, the anthocyanin of the upper spot had an R_f of 0.39 in 1% HCl while the R_f value of the lower spot was 0.38.

It is impossible that 'Orchid' is the result of hybridization between *M. stellata* and *M. liliflora*.

M. tripetala L.

Only the filaments of the anthers are colored (purplish) in the umbrella magnolia. The 3-rhamnoglucosido-5-glucosides of cyanidin and peonidin were the only anthocyanins present, with the cyanidin compound predominant.

M. × *Soulangiana* Soul. 'Lennei' and Alexandrina'

The cultivars designated as *M.* × *Soulangiana* are derived from hybridization between *M. liliflora* Desrouss. and *M. denudata Desrouss.* or are segregates from such hybrids. With the exception of the anthers of 'Lennei', all extracts gave two spots in BAW (0.33 and 0.27) and in 1% HCl (0.43 and 0.22). The lower spot (BAW) was inseparable from the anthocyanin of *M. Sieboldii*. Peonidin was the only aglycone detected and the 3, 5-diglucoside and 3-rhamnosido-5-glucoside were the glycosidic types. Anthers of 'Lennei' lacked the 3, 5-diglucoside, however.

M. liliflora Desrouss.

Based on chemical evidence, the specimen collected as *M. liliflora* should probably be considered as a type or segregate of the hybrid *M.* × *Soulangiana*. The anthocyanins are the same as 'Lennei' and 'Alexandrina' and quite different from those of both plants of *liliflora* 'Nigra'. This plant lacks cyanidin glycosides, which were found in *M. liliflora* by Hayashi and Abe (1953). (Fig. 35)

M. liliflora Desrouss. 'Nigra'

The two specimens of this cultivar differed considerably in their anthocyanins. The petals and anthers of the Morris specimen gave spots at 0.31 and 0.27 in BAW and a single spot at 0.20 in 1% HCl. The anthocyanins were cyanidin 3,5-diglucoside and peonidin 3,5-diglucoside. The Barnes specimen likewise contained both cyanidin and peonidin but the major glycoside was the 3-rhamnoglucosido-5-glucoside. In addition, the petals also contained a small amount of cyanidin 3-glucoside, the only monoglucoside found in this survey.

This variation between cultivated plants growing under the same name is not surprising considering the vagaries of the nursery trade, chance mutation or hybridization, and the commercial selection process which allows only a few individuals to be widely propagated. Both specimens did, however, contain cyanidin and peonidin, as reported for the pure species by Hayashi and Abe (1953). Furthermore, it is possible that the two specimens may differ by only a single gene that governs the addition of rhamnose to the diglucoside.

M. obovata Thunb.

The filaments and pistils of this species were purplish and the sepals had a pinkish-red cast. (Fig. 36) Peonidin was the only aglycone found after hydrolysis of the purified pigments, although cyanidin, probably from leucocyanidin, was present in the hydrolyzed extract. Both filaments and pistils gave two spots in BAW and 1% HCl, which were inseparable from those of 'Lennei'. The sepals gave only the 3-rhamnoglucosido-5-glucoside, which was inseparable from the anthocyanin of *M. Sieboldii*.

M. macrophylla Michx.

The large-leaved cucumber-tree has a blue-purple blotch, varying from a faint irregular line to a triangular spot, about 3 cm. from the base on the inner surface of the 3 inner petals. (See Cover) On only one of three Arboretum trees was this spot of sufficient intensity to allow extraction of enough anthocyanin for identification purposes. Cyanidin 3, 5-diglucoside was the only anthocyanin.

M. grandiflora L.

The filaments of this species contained only peonidin 3-rhamnoglucosido-5-glucoside. A seedling derived from a putative hybrid cultivar produced, in addition, the cyanidin glucoside of this type. Further mention of this will be found in the "Discussion". No malvidin was found in *grandiflora* (or any other species of cultivar tested), whereas Forsyth and Simmonds (1954) reported a malvidin glycoside in this species in Trinidad. In view of the natural range of *M. grandiflora,* which does not include Trinidad, and the occurence of some 15 to 17 tropical or sub-tropical species, some of which are evergreen, it is suggested that the specimen investigated by Forsyth and Simmonds may not have been *M. grandiflora*.

Discussion

The widespread occurence of peonidin glycosides in *Magnolia* flowers may be considered unusual. According to Harborne (1963b) "Peonidin is uncommon in the flowers of wild plants mainly because the systems for methylation and for adding the third hydroxyl group to the anthocyanidin B-ring appear to have evolved to-

gether; the result is that malvidin predominates." Thus it is possible that the malvidin glycoside found in *M. grandiflora* (or some other species?) by Forsyth and Simmonds (1954) may be the result of such a situation.

The absence of cyanidin glycosides in cultivars of *M.* × *Soulangiana* is also unusual in view of the presence of both cyanidin and peonidin in the parental species *M. liliflora* (Hayashi and Abe, 1953) and in the cultivar 'Nigra' as reported above. It may be that in the hybrid, genes for methylation from the hexaploid (2n=114) *M. denudata* largely checked the action of those genes of the tetraploid (2n=76) *M. liliflora* which allowed the production of the non-methylated cyanidin. Harbone (1960b) has reported the existence of at least two genes controlling methylation in *Primula* (primrose).

Whereas a single peonidin glycoside was found in *M. grandiflora,* a seedling resulting from open pollination of *M. grandiflora* 'Charles Dickens'[2] produced both cyanidin and peonidin glycosides. The "Dickens" tree is probably a hybrid between *M. grandiflora* and *M. virginiana,* a species which lacks floral pigmentation. Since the seedling most likely belongs to the extremely variable second hybrid (F_2) generation, it is possible that methylation was partially prevented by the action of genes originating in *M. virginiana.*

M. virginiana is also a parent, along with *M. tripetala,* of the hybrid *M.* × *Thompsoniana* (Loud.) Sarg. While the filaments of *tripetala* are brightly colored, there was no pigmentation in the single hybrid specimen that was observed.

Based on cytological evidence, *M. stellata* 'Rubra' was considered to be a hybrid between *M. stellata* and *M. liliflora* by Janaki-Ammal (1953). The pigmentation of the cultivar 'Rosea', however, is not necessarily the result of hybridization. The cyanidin glycoside found in this cultivar is the same as that produced in the true species under favorable environmental conditions.

The primary glycosidic class of *Magnolia* anthocyanins is the 3-rhamnoglucosido-5-glucoside. There is a mass of evidence supporting the idea that glycoside synthesis takes place by stepwise addition of single sugar residues, and a gene is known in *Streptocarpus* (Cape primrose) that controls the addition of rhamnose to the 3, 5-diglucoside (Harborne, 1960b). Thus, it is possible that the two specimens of *Magnolia* which contain only the 3, 5-diglucoside lack only a single gene with a similar function.

[2] See article by Jewel W. Templeton, Morris Arb. Bull. 16; 8-9, 1965, for story on this cultivar.

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Associate's Corner

In Praise of Binomials[1]

I used to think a "binomial" was some kind of potted plant, like "begonia" or "geranium." Then, as I became acquainted with people at the Arboretum, I found that in speaking of plants they used Latin names rather than common names and that these Latin names were "binomials." Sometimes the situation was embarrassing. Someone spoke to me of *Typha latifolia,* and I had to retreat behind a glassy stare until I realized that this meant cattails — of course, those friends of my childhood! *Eupatorium purpureum* turned out, after an uncomfortable interval, to be Joe-pye-weed, and so on.

One day I made a resolution. I said to myself: "I will LEARN some of these names. I will no longer hide behind the excuses of advancing age and fading memory. I will take what memory I have and put it to work. Perhaps I can learn only a few — say ten or twelve or even twenty, but I will learn them well. I will practice them by day and take them to bed with me at night. And I will use them freely in conversation."

Not long after that I went to the Arboretum to ask where in the Pine Barrens I could find bog asphodel. I have always thought that was a beautiful name, but I looked up its binomial, practiced it, and asked quite easily about *Abama americana*. The answer came in a shocked voice "That name has not been used for fifty years. The word you want is *Narthecium*." And then and there I learned something about the Rules of Botanical Nomenclature, about International Congresses, controversies, and changes in usage.

A little dismayed by the complexity of it all I wandered into the library, and there I found a book called "How Plants Get Their Names" by L. H. Bailey. Now this is a very good book. The title of the first chapter is "On My Table", and there is an account of a potted plant, the familiar "Jerusalem cherry." One senses at once the warm, friendly feeling the author has for the plant. He speaks of his "partnership" with it, and the "quiet satisfaction" he has in the care of it.

He notes the name on the seed packet and comments that the plant is not native to Jerusalem, in fact has no connection with that area. Geographical names, he says, are often misleading. An "African marigold" comes from Mexico; the "Cherokee rose" is from China; "English walnut" is not English; "French mulberry" is not French nor yet a mulberry.

On the seed packet he finds another name: *Solanum Pseudo-Capsicum,* and the next ten pages are devoted to the story of how this plant got its name. The story involves famous botanists of other countries, ancient tomes and hundreds of years. He enjoys the story and so does the reader. His final comment is "Centuries are tied together."

The second chapter is about Linnaeus. I had known Linnaeus only as "Linn.", four letters sometimes found after the name of a plant in a list. Four letters, dry as dust. But here is his portrait, showing a warm, kindly face with humor and understanding, — a man one would instinctively like. Carl Linnaeus, born in Sweden in 1707, was destined to become the Father of Botany. He was the creator of the binomial system, and if we think of binomials as difficult we have only to read what he had to work with in order to create any system at all. For example, catnip had been defined as *"Nepeta floribus interrupte spicatis pedunculatis",* which is a brief description of the plant. Linnaeus, with his new concept of genus and species as categories, named it *Nepeta cataria,* as we have it now. His system, says Bailey, is "Beautiful in its simplicity." It serves all men and women. "It answered the purpose of Linnaeus and his associates when the number of known plants was few; it is in daily use one hundred and eighty years later, when plants are numbered in the hundreds of thousands." Then he adds, with an ardor that is contagious, "To know the names of the forms of life is one of the keenest of satisfactions; it brings one into relationship with living things in endless variety; it multiplies the contacts."

Linnaeus brought order into the study of plants. L. H. Bailey loved order — and so, we are reminded, did Charles Darwin — because he found in it beauty and also truth. "To give a plant its right name is to tell the truth about it." And to know its right name there must be a clear system. I have always shied away from the word "systematics" as from something cut-and-dried, dull. But not in this book. It is here a lively study, "full of delightful puzzles."

The rest of the book is as interesting as the first two chapters. There are exhaustive accounts of how certain plants got their names, like that of the Jerusalem cherry. A bit arduous to read

[1] For this issue Mrs. Rivinus has graciously extended the courtesy of her Corner to a fellow Associate.

but to the author each one is a "sweeping, fragant journey" . . . and so it becomes to us.

Bailey does not scorn common names. They, too, have interesting histories that provide fertile study. He even suggests works of reference in that field. But we are continually reminded that they lack precision and are therefore often misleading. "Pineapple" is neither a pine nor an apple. "Horse chestnut" has nothing to do with a chestnut, and so on.

The author makes no bones of the fact that plant nomenclature is difficult, partly because of the changes that occur in accepted usage, and also because of the different "codes" used in different parts of the world. If the American Code differs from that of the Botanical Congress held in Vienna in 1905, what are we to do? Apparently we had better know both names and make our own decision. This is a growing science, and we must grow with it. There are differences of opinion in other sciences such as astronomy; new concepts come into the picture as well as new stars, and these are often upsetting and disconcerting. But we take them in and work with them. Why should we expect so important and rewarding a study as the naming of plants to be easy?

So I shall go on adding as I can to my small store of binomials — not to make a good impression on people, (that hope died with *Abama americana*) but for the sake of extending my horizon a little with glimpses of far-off lands and of men living centuries ago who worked with plants and plant names as such people do today, with devotion and delight.

PHOEBE CROSBY

Arboretum Activities

(Continued from Page 38)

DEATH OF JAMES O'NEIL

It is with a deep sense of loss that we record the death, on July 16, of James J. O'Neil who, from 1932 until his retirement in 1959, had served as Custodian of the Morris Arboretum.

Readers of the Bulletin will recall the fine tribute paid to Jim by Marion Rivinus in an article entitled "A Man of Many Parts," which appeared in her Associates' Corner in the issue of July, 1963.

THE SUMMER COURSE

For the eleventh successive year the Director, aided by members of the staff, conducted a six weeks graduate level course on the "Identification and Recognition of Woody Plants." Again, as in the past two years, Mr. A. E. Murray, Jr., served efficiently as Laboratory Assistant and Collector.

The class was composed of 24 students, half of whom were high school teachers of science who were in attendance as participants of the National Science Foundation's Summer Institute. Most of the remaining members were graduates in the University's program of Landscape Architecture, for whom this is a required course. Four students registered through the summer school office for graduate credit in Botany.

Members of the group learned to recognize more than 500 species of trees, shrubs and woody vines. This was accomplished by laboratory study, daily walks through the Arobertum and field trips to nearby areas of botanical interest including an all-day excursion to the New Jersey Pine Barrens. By the time they have completed the course these students are equipped to recognize every genus and most species of native trees and shrubs which they will encounter in this section of the country as well as most of the commonly cultivated exotic genera of woody plants.

MEXICAN BIBLIOGRAPHY HONORED

In the March, 1965, issue of this Bulletin there appeared a review of Mrs. Ida K. Langman's "Selected Guide to the Literature on the Flowering Plants of Mexico", which was published as a Morris Arboretum Monograph.

It is now extremely gratifying to be able to report that this monumental work, compiled by a member of our own botanical family, has been awarded the Oberly Memorial Award Citation for the "Best Bibliography submitted in the field of Agriculture or Related Sciences for 1963-64." This citation, given by the Reference Service Division of the American Library Association, is awarded in memory of Eunice Rockwell Oberly, former United States Department of Agriculture Plant Industry Librarian.

All of us at the Arboretum join in congratulating Ida Langman on this well deserved recognition of her quarter of a century's dedication to the study of Mexican botanical literature.

The Drought

For the fourth year in succession this section of the country has been in the grip of a prolonged precipitation deficiency. As this issue goes to press the Philadelphia area is nine inches below its normal rainfall average for this time of the year. What this will mean to the many thousands of plants growing in the Arboretum can at this time be the subject only of the wildest conjecture. In a future issue we shall attempt more fully to assess the effects of this abnormal climatic aberration.

J. M. F., Jr.

The Arboretum on T.V.

The period from June 19 to the 23 was "the week that was" at the Arboretum. Crews from WCAU-TV visited the Arboretum on four separate occasions for preparation and filming of two different shows. The first of these was the 'TV 10 Reports' presentation of "Happy July the Second", with the Mansion and the Rose Garden serving as a background for readings from the diary of Sally Wister. Part of this was recorded *in situ*. The second show was a production ballet sequence for the popular 'Pixanne' children's program, also filmed in the Rose Garden.

One little-known fact that emerged from all this was that the Arboretum is a very noisy place. Several times during the filming, audio engineer Ralph Rodio had to interrupt the shooting. The reasons: jet airliners, crow, helicopter, a truck straining up Germantown Avenue, and a fight between two unidentified birds hidden in the foliage of a European beech. Normally, of course, we regard the Arboretum as a restful respite from the cacaphony of modern living, but when you are listening for silence, man, is it noisy!

F. S. S., Jr.

Cytological Notes: Introduction and I. Callicarpa

Frank S. Santamour, Jr.

In the introduction of their compendium of chromosome numbers, Löve and Löve (1961) referred to cytotaxonomy (the relating of chromosomal and morphological data) as ". . . the most effective tool for modern evolutionary classification of plants. . ." Yet with a burgeoning scientific literature, less than one-tenth of the more than 250,000 species of higher plants has been examined cytologically.

The majority of the species whose chromosome numbers have not been determined are, as may be expected, native to the tropics or sub-tropics, where the major botanical activities in the past have been exploration and collection. Thus the plants native to Europe and temperate North America, and those exotic species that can be grown in these regions, have received a disproportionate amount of attention from cytologists.

However, there are still gaps in our cytological knowledge of native and acclimated plants and, in some cases, unresolved divergencies among reports of different investigators. These gaps are seldom sufficiently wide to allow a comprehensive study of a genus, sub-family, or higher taxonomic grouping based entirely on original observations. Putting it another way, there is seldom enough "meat" for a sizeable research paper. Because of this lack of inducement for research, caused in part by the well-founded discouragement of short papers by many scientific journals, it is likely that such gaps will remain.

Löve and Solbrig (1964) recognized this situation and, in an attempt to alleviate it, initiated a series of reports in the journal 'Taxon' designed to encourage the publication of documented chromosome counts that had not been reported mainly because of the lack of a suitable publication medium. Generally these reports (of which five have been published at this writing) have dealt with plants collected from their native habitats, with locality data and notification of voucher herbarium specimens being given.

In any arboretum or botanic garden, however, where most of the plants are mainly of horticultural importance, the exact origins of a plant are seldom known. Furthermore, in Löve and Solbrig's series, there is no opportunity to discuss the horticultural importance of a plant, review earlier papers, or to analyze the reasons for discrepancies among previous chromosome number determinations.

Therefore, we feel justified in initiating a series of 'Cytological Notes', based mainly on plants growing at the Arboretum, that should help to

fill in the cytological "gaps" among cultivated woody plants. Some notes may deal with a single species, others may include all available species of a given genus, while still others may include species of two or more related genera. Specimens of all material utilized will, so far as is possible, be represented in the Arboretum herbarium.

The first of these Notes follows:

1. Callicarpa

The genus *Callicarpa* (Verbenaceae) contains between 40 and 142 species, depending on the authority consulted, mostly native to the warmer regions of the Old World. Li (1963) has recently reported on the hardy cultivated species, and also checked the identity of the specimens investigated in this study.

Darlington and Wylie (1955), in their Chromosome Atlas, list only two previous counts in *Callicarpa,* both for *C. japonica* Thunb. Sugiura (1936) determined the diploid number as 2n=16. A count of 2n=18 is ascribed to T. Patermann (1938). Unfortunately, the reference to the latter work is not included in the Atlas's bibliography.

Standard aceto-carmine squash techniques were used with both root tips and pollen-mother-cells that had been fixed in 1:3 acetic-alcohol. Microscopic examination was made under oil immersion and representative plates were drawn with the aid of a camera lucida.

C. americana L. (M 64-438) was available only as seedlings grown from seed collected in Mississippi. A considerable number of these seedlings were made available to the Associates during the 1965 plant distribution. The somatic chromosome number in root tip mitosis was 2n=36. Counts at meiosis in *C. japonica* (M7830) and *C. dichotoma* (Lour.) Koch (M4802) gave n=18.

Thus the results of the present study agree with the unseen report of Patermann with regard to the probable basic number of x=9. The three species studied must be considered as tetraploids (4x). Based on such limited information, no explanation can be offered for the divergencies in basic number (x=8, 9) and in the ploidy of *C. japonica* (2x, 4x). However, the Verbenaceae contains many genera for which two basic numbers have been reported, even in the same species. The existence of diploid and polyploid forms of the same species is more common, and may be the case in *C. japonica.* An accurate appraisal of the cytological situation in *Callicarpa* will result only from a critical cyto-taxonomic study of a large number of species.

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Arboretum Activities

THE STAFF

On September 23 the Director delivered an illustrated lecture before the Sedgeley Club on "Autumn in Philadelphia." From October 13 to 17 he represented the Arboretum at the 20th Congress of the American Horticultural Society and the annual sessions of the American Association of Botanical Gardens and Arboretums which were held concurrently at the Callaway Gardens, Pine Mountain, Georgia. Following the banquet of the A.A.B.G.A. on October 16 he gave an illustrated lecture on "Some European Botanical Gardens", a talk which he repeated on November 4 before the members of the Community Garden Club of Wayne, Pa.

At the annual dinner meeting of the Philadelphia Chapter of the American Rhododendron Society, held at the Union League in Philadelphia on October 21, Dr. Fogg was the principal speaker; his topic was, "The New Heath Garden of the Morris Arboretum." On December 2 he gave an illustrated talk on "The Morris Arboretum's Iberian Tour" to the alumnae of the Arboretum of the Barnes Foundation in Merion.

(Continued on Page 61)

A Botanist in Hong Kong

Hui-Lin Li

A Tourist's Mecca

Hong Kong, one of the most popular cities of tourism in the world today and certainly the most frequented by travelers in the Far East, is famous especially for two attractions, shopping and dining. The myriads of stores, varying from huge block-wide multi-storied emporiums and arcades to tiny open street stalls, line continuously and compactly most of the teeming streets and alleys over the entire city areas. Being a free port and without sales taxes, manufactured goods from other countries frequently sell here at a lower price than in their native lands. Local produce and products as well as services are cheap because of abundance of low cost labor. In Hong Kong one can literally obtain any kind of merchandise originating from anywhere in the world at a very reasonable price, provided, however, that he has the temerity, patience and especially the acumen to bargain with the very shrewd traders. It is oftentimes more advisable to go straight to the larger one-priced department stores instead.

About eating, it goes without saying that Chinese cooking is universally acclaimed as among the best in the world. Gourmets, however, if not experienced enough, can be bewildered by the varied cuisines offered by the innumerable eating places in Hong Kong. Famous recipes derived from all regions in China, from Mongolian and Pekinese in the north, to Szechuanese and Hunanese in the west, Shanghai, Soochow, and Hangchow in the east and Cantonese and Fukiense in the south, are offered by many restaurants, large and small, each specializing in one or the other kind. Their menus are frequently very extensive and vary from season to season. Each must contain those special dishes known only to their particular branch of the culinary art. It is advisable to secure first the necessary information about these restaurants from local residents as their qualities and standards may be quite different.

Fig. 37. View of the harbor from Victoria Peak.

Fig. 38. The south side of Hong Kong island from Victoria Peak; a reservoir in the distance.

Besides shopping and eating, Hong Kong is also a wonderful place for sight-seeing. The Peak tram, supposed to be the steepest cable car in the world, takes the rider to the top of Victoria Peak, 1,800 feet above sea level, where a panoramic view of the beautiful harbor can be seen on one side (Fig. 37) and an expanse of the sea and coast on the other (Fig. 38). The many fishing villages, scattered around the Colony, are picturesque and interesting (Fig. 39). Among these the most famous one is Aberdeen with its huge elaborately decorated floating restaurants of seafood where the customer is ferried back and forth by small motor boats or sampans (Fig. 40). These two places, Victoria Peak and Aberdeen, are the two musts on the circuit of nearly every visitor.

Open-air and out-door recreation is possible the whole year round in this mild climate. The

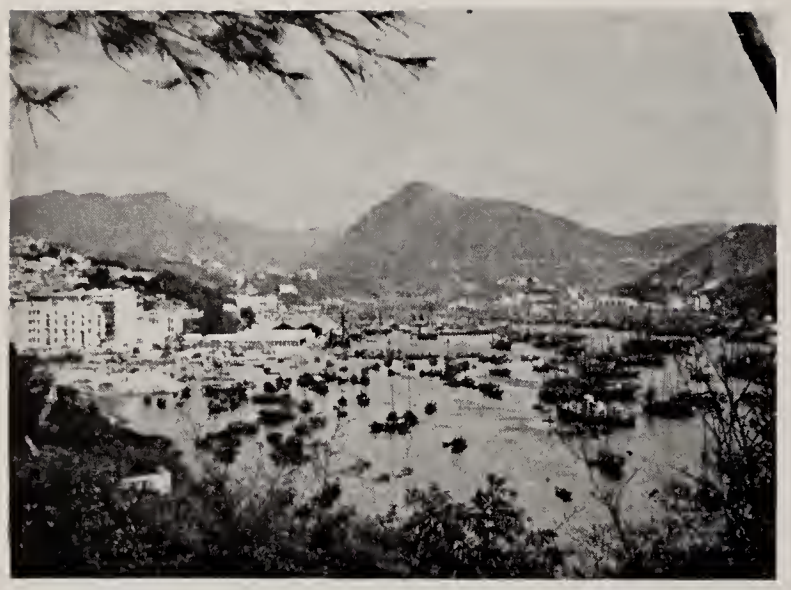

Fig. 39. A peaceful fishing village, Tai Po, in the New Territories.

many bathing beaches are open in almost all months. Many other sports, such as football (soccer), golf and sailing are all very popular. For less strenuous diversions, there are a number of temples and monasteries as well as private villas and gardens, both in the city and in outlying areas, that are worth visiting. The not too distant Portuguese colony Macau can be reached by comfortable ships or hydrofoils which take only about an hour. This small city, the oldest European colony in the Far East, still retains the charm and quietness of a residential town, quaintly southern European in appearance and atmosphere, and offers a welcome change from the congested bustling life of Hong Kong. It is the Monte Carlo of the East, where casinos and all forms of gambling are sanctioned by the government.

The Chinese University

Tourism, however, no matter how attractive, was not the primary reason in bringing me to Hong Kong. My year's assignment carried the duty of a professional biologist.

Fig. 40. Aberdeen on Double Five Festival; one of the racing dragon boats is shown.

The population of Hong Kong has been increased dramatically from about half million at the end of the last war to the present nearly four million. (The last official estimation at the end of 1964 is 3,739,900). As a result, among other things, numerous schools at all levels have since been opened. These include a number of "post-secondary" colleges, financed by private resources. In order to raise the academic standard and to increase the enrollment in higher education, the government, besides maintaining the fifty-odd year old Hong Kong University, supports the federation of three existing private colleges of special merit into a new Chinese University of Hong Kong. The instruction at this new University, inaugurated first in 1964, is given bilingually in Chinese and English. My assignment was to go there as their first Professor of Biology.

Fig. 41. In the Hong Kong Botanical Garden; the tree is the American *Taxodium distichum*.

The three component colleges are Chung Chi College, a college of arts and sciences sponsored originally by the Board of Christian Colleges in China, New Asia College, an arts and science college established after the war by refugee scholars from the mainland, and United College, a college of arts, science and commerce formed by local educational circles. The campus of the first named is situated in the outskirts of Kowloon, Ma Liu Shui, a hilly area by the sea about seven miles from the city by rail. The other two colleges are now located in Kowloon and Hong Kong respectively and will eventually move out to join the former. The plan is to establish a central University campus at the site close to Chung Chi at Ma Liu Shui. There will be a University area with laboratories, classrooms, offices, dormitories, library, gymnasium, etc. and adjacent campuses for the three colleges,

Fig. 42. The highest mountain, Tai Mo Shan; *Aleurites Fordii* in the foreground.

each with its own self-sufficient establishments. Each of the three colleges maintains its individual status while the University determines overall policies, exercises general administration and conducts courses and research at the upper undergraduate and graduate level. It follows somewhat the pattern of a British university.

The new campus, on high grounds along the coast overlooking the Tolo Bay, commands a sight of grandeur and spaciousness. The area is a very hilly one and grounds are now being leveled in preparation for construction. Among those planned for immediate erection are four science buildings for physics, chemistry, biology and mathematics, forming together a unified compound. The laboratories for each of these buildings are designed with the help of specialist-consultants.

At present two of the colleges, namely Chung Chi and New Asia, have departments of biology. They are well equipped for instructions in the basic fields of biology. Courses leading to majors in botany and zoology are offered. The staff consists of competent scholars in various fields and the majority of them are PhD graduates from American universities. The two departments graduate together about thirty-five majors each year. The students, matriculated only by a competitive entrance examination in the ratio of about one in ten, are a highly intelligent group. They are, in general comparison with the students in this country, much more studious and serious in their studies. The reason is apparently due to the emphasis on examination as is usual with the British system. A comprehensive series of written examinations including laboratory works, covering all major subjects, is given at the end of their senior year. These examinations are conducted under the supervision of an "external examiner" invited from universities abroad. The outcome of these examinations determines the fate of the student, whether he

Fig. 43. Mangrove formation along coast near Tai O village, Lantau island.

Fig. 44. A terraced valley on Lantau island.

will be entitled to graduate with a degree, or without one, or he has to repeat his studies or even drop out from college. With this critical ending in sight, the four years' studies of the student are more or less geared at preparing for the final decisive evaluation of his achievements. It seems that, along with this, the student is somehow deprived of the opportunity of seeking knowledge freely at his own initiation and according to his own interest. This I consider a great drawback of the system. The University has also taken notice of this and has now formulated plans to de-emphasize examinations.

Plant Observations

My task as Professor of Biology and Director of University Studies in Biology coordinated the activities of the two college biology departments. Though administrative duties kept me fairly busy most of the time, an opportunity to

Fig. 45. *Pinus Massoniana* along hillside.

teach a course in plant taxonomy gave me time to look into the local flora. Also on week-ends, outings to more distant places offered chances to observe, though necessarily only casually, the vegetation. Although Hong Kong is heavily populated, the population is mainly concentrated in densely settled urban areas. The countryside in the New Territories (amounting to 365½ square miles out of a total of 398¼ square miles area of the Colony) is still sparsely populated. There are many islands, the larger ones with scattered fishing villages and the smaller ones mostly uninhabited. Most of these outlying areas are still covered with luxuriant growths of plants. There are regular ferries plying between the larger islands and Hong Kong while the smaller ones can be reached by small launches.

Hong Kong lies just inside the tropics but the climate is tempered by its coastal location. The summer season is hot and damp but the long winter season is cool, dry, and sunny. These bright winter months offer a pleasant time for field study. The flora is tropical in nature but at about the northern limit of the tropical flora. As the winter is not very cold, plants can be seen blooming all year round. Visitors may notice the fact that many a genus tends to produce a greater wealth of flowers of larger size in Hong Kong than it does in other tropical countries. This is due to the characteristic climatic conditions, the alternation between hot humid summers and cool dry winters. This alternation tends to cause some tropical plants to be dormant during winter and encourages the development of larger flowers borne at definite seasons of the year.

Visitors who do not have time to explore the countryside can visit the Botanical Gardens at the mid-level of Hong Kong island (Fig. 41). The area is not extensive, nor are the collections, but there is a good representation of local and introduced plants both on the ground and in the shade houses. Also readily accessible are some of the water catchment areas where semi-natural vegetations are maintained for collection of rain water above the several reservoirs. These areas, with foot-paths leading in various directions, are excellent places for observation of plant growths.

Hong Kong has good roads both on the main island and in the New Territories. Further hiking is necessary to reach less accessible places for plant studies or collecting. There are certain valleys, ravines, or creeks known especially for their growth of plants. Some areas, for instance, are known for their large number of orchids, others for *Alpinia,* for ferns, or other interesting groups of plants.

As noted above, the settled areas are at present largely limited to a few highly congested areas. However, the rapidly increasing population is encroaching on outlying regions. If ways are not devised for protection, the natural vegetation of most of these open areas may soon be disturbed or destroyed. The government is now active in conservation work and plans are being made to establish certain "national parks" or "nature preserves." Certain islands or peninsulas are to be set aside and specially protected for both the wild plant and animal life. Accommodations for visitors will be provided in restricted areas as well as staff for guiding and instructing the visitors. It is hoped that these plans can be successfully carried out soon while there are still areas worth preserving.

The Flora

It is estimated that Hong Kong has about 180 species of ferns and 1,500 species of flowering plants. There are quite a number of endemic species. A most interesting recent find is the dis-

Fig. 46. A shady ravine with tree ferns.

Fig. 47. Nun Orchid, *Phaius grandiflorus.*

covery of a new species of *Camellia, C. Granthamiana* (named after a former governor), in 1956. The species has the largest-sized flower in the genus. Only one single tree so far has been found, on the edge of a wooded ravine near the Jubilee reservoir. It bears white flowers five and a half inches across with a dense tassel of golden stamens. Seeds and grafts have now been widely distributed to institutions abroad. In recent times, new species have also been reported in such genera as *Maackia, Diospyros, Ailanthus,* and *Pandanus.* These have all been found by casual or occasional studies and not due to an organized survey of the flora. As a matter of fact, the flora has not been studied systematically in the last half century. This is all the more surprising as Hong Kong boasts of the first colonial local flora of the British Empire: George Bentham's *Flora Hongkongensis,* published in 1861. This is an excellent treatise, one considered as a model of regional floras at that time. Botanical explorations were actively pursued then and until the early part of the following century, culminating in the publication of the *Flora of Kwangtung and Hongkong* by S. T. Dunn and W. J. Tutcher in 1912. Bentham's flora is a detailed treatment of all groups with descriptions and keys but it covers only the Hong Kong island proper. Dunn and Tutcher's work is a more simplified version, with only keys and no descriptions, but it covers a much more extensive area geographically including mainland Kowloon as well as other parts of the Kwangtung province of China.

The collections of these early explorations are mainly preserved in the Hong Kong Herbarium of the Urban Service Department in Hong Kong and in the Kew Herbarium near London. After the twenties, however, botanical survey work became less active and the Hong Kong Herbarium is at present maintained largely as a reference collection for local reforestation work. It publishes a check-list of plants in mimeographed form based on its own collections. There is actually, as the case of *Camellia Granthamiana* shows, an urgent need of a more complete survey before the present rapid spread of population destroys most of the natural vegetation. Also, many species known to occur in this area are in need of critical re-study both taxonomically and nomenclaturally in the light of newer and wider knowledge on the flora of Eastern Asia as a whole. In the last fifty years, floristic studies on adjacent areas such as Indo-China, Indonesia, the Phillipines, Taiwan, Kwangtung, Kwangsi and Hainan have been actively pursued by many botanical institutions and individual botanists. It is highly desirable that the Hong Kong area should also have a modern census of its flora. It is the last remaining area of Chinese mainland that is still accessible to scientists from the outside world.

The Vegetation

In the Hong Kong area the types of vegetation one can observe vary from those of the coastal areas to mountains ascending to an height of 1,800 feet (Victoria Peak) on Hong Kong island and to over 3,400 feet (Tai Mo Shan) on the mainland side. (Fig. 42).

Along the sandy beaches the common plants are the grass *Spinifex littoreus, Vitex,* beach morning-glory, as well as scattered screw-pines, *Caesalpinia, Crinum,* etc. The muddy shores frequently have a dwarf mangrove formation by small Rhizophoraceae or some other plants. (Fig. 43).

Much of the lowlands are in cultivation frequently as vegetable gardens but some rice pad-

Fig. 48. *Mussaenda pubescens,* common in Hong Kong and southern China.

Fig. 49. *Caesalpinia vernalis,* an endemic.

dies are also found. The hillsides are sometimes also terraced for cultivation. (Fig. 44). The common trees planted around the villages are the banyan, *Ficus retusa,* camphor and clumps of bamboos. More recent introductions include *Casuarina* and *Eucalyptus.* Fruit trees grown include lychee, longan, loquat, pomelo, tangerine, banana and varieties of Chinese plum and pear as well as introduced species such as papaya, pineapple, custard apple and guava. Many kinds of trees are planted for ornament. Among the cultivated trees the most interesting is *Bauhinia Blakeana* (named after another former governor), the Hong Kong Orchid Tree, recently chosen as the "National Flower". It was first discovered in 1908 by the Fathers of the French Foreign Missions at Pok Fu Lam, on Hong Kong island. The tree has large purple flowers and is among the finest of the *Bauhinia* genus anywhere in the world. Its origin is unknown and it is apparently a sterile hybrid, never producing seed.

To the casual observer the hillsides and mountain slopes often appear in a distance quite open and covered by grass and not of any vegetation. This is due in part to frequent burning over. On closer look at the seemingly bare mountain sides, the water courses are always marked by dense shrubbery growth and scattered trees. The pine, *Pinus Massoniana,* is the most common tree on open hillsides together with the common *Pteridium* and a *Gleichenia* (Fig. 45). Some less exposed areas, especially those protected by the government, are more heavily wooded. The dense vegetation of deep ravines and shaded gullies is rich in flowering shrubs, ferns and tree ferns (Fig. 46). Giant aroids are also common. There are begonias, balsams, and members of the Gesneriaceae, Urticaceae and Compositae. Orchids, of which no less than seventy species are known, are rarer and more local in distribution. Most of the epiphytic species have small flowers but some of the ground orchids are very beautiful and several are widely cultivated abroad. The best known local species is the Nun Orchid, *Phaius grandiflorus,* bearing flowers four inches across with white petals and a purple lip (Fig. 47). It is found on several mountains especially along damp creeks.

Interesting Plants

There are species in such genera as violets, clematis and honeysuckles, familiar to temperate residents. There is a wild iris, *Iris speculatrix,* a small-flowered species, of more southerly occurrence than any other true iris. There is a wild lily, *Lilium Brownii,* with large white flowers somewhat purple-streaked. The Chinese bellflower, *Platycodon grandiflorus,* with large violet flowers, widely distributed in Eastern Asia, is common on grassy slopes on the south side of the Hong Kong island.

Among the many shrubs or small trees the common ones are *Rhodomyrtus, Melastoma, Gordonia, Gardenia, Mussaenda, Rhaphiolepis, Eurya, Callicarpa* and *Rhododendron.* Notable are several species of *Camellia.* All of the camellias have white flowers except one, *C. hongkongensis,* with red flowers which is known only on Hong Kong island in the Peak district. It is a small tree blooming in the winter months. *Gordonia axillaris,* resembling camellia in general appearance, is common. Another camellia-like species is *Tutcheria spectabilis,* with large white flowers tinted with gold. There is also a wild species in such genera as *Magnolia, Michelia, Rhodoleia, Illicium, Litsea, Styrax, Ardisia, Chloranthus,* and *Enkianthus.* The last named plant, *E. quinqueflorus,* is a lovely flowering shrub which bears beautiful pink bells in early spring at the time of the Chinese New Year and is therefore in much demand as an ornamental. This and certain other plants, such as camellias, magnolias, orchids and azaleas, are now under special protection by regulations made under the Forestry Ordinance.

Plant species in Hong Kong include those which are wide-spread either pantropically, or in the tropics of Asia, or in southern China in general, as well as those that are restricted in distribution, either limited in their range to Kwangtung province or sometimes even endemic to Hong Kong only. As examples, *Mussaenda pubescens,* with beautiful clusters of white flowers, is a common plant in Hong Kong and also throughout southern China (Fig. 48), while *Caesalpinia vernalis,* also highly ornamental with its spikes of golden yellow flowers, is common in ravines in Hong Kong but endemic only to the island (Fig. 49).

Altogether the Hong Kong flora is a very rich and interesting one. It is a part of the flora of southern China. It seems regrettable that the flora of this strategic region has been considerably neglected in the last fifty years. A complete census of any local flora is a prerequisite to other botanical studies. In Hong Kong, with its recent greatly accelerated academic and scientific developments and activities, this need is especially felt. It is hoped that before the ever-expanding population disturbs more of the vegetation and destroys some of the rarer species, ways and means can be found to protect and preserve some parts of the natural vegetation and that an up-to-date survey of the flora can be made.

Arboretum Activities

(Continued from Page 54)

Dr. Fogg has recently been elected a member of the Board of Directors of the Friends of the Wissahickon.

On Thursday, November 4, Dr. Santamour presented the regularly scheduled seminar in the series offered by the Department of Biology. His subject was, "Insects, Resins and Resistance."

This autumn Dr. Allison's students in Botany 207 (Biology of the Lower Plants) were based at the Arboretum for conferences, research, and field work dealing with the fungi. On October 13 Dr. Allison gave one of the Eli Kirk Price III lectures entitled "Modern Problems in Plant Pathology" and on November 8 she spoke on "You and The Fungi" to the Outdoor Gardeners Club. On November 8 she was guest lecturer at the Biology Graduate Students Research Seminar and on November 15 she visited Dr. Fritz Blank's mycology research section at the new Skin and Cancer Hospital.

Mr. Dourley attended the meetings of the Association of Kew Gardeners of America which took place at the New York Botanical Gardens on October 25.

Board Member Honored

At the Awards Dinner of the Congress of the American Horticultural Society, held at Callaway Gardens, Georgia, on October 14, Dr. William C. Steere, Director of the New York Botanical Gardens and a member of our Board of Managers was awarded the Liberty Hyde Bailey Medal of the Society. This award was accompanied by the following citation:

"Your outstanding work as a teacher of botany and biology, for your thoughtful direction of graduate student planning and research programs. for the guidance and leadership you have clearly given to the various collegiate departments you have headed and the renowned institution you are presently directing, as well as the national and international organizations you have served as president, for your studies of bryophytes of the Arctic and Antarctic regions of the world, and for the sound contributions you have made, by writing and fulfilling editorial responsibilties, to our present botanical knowledge."

Fall Planting

Due to the prolonged drought of late summer and early autumn our regular fall planting activity has been greatly curtailed. For every plant that was moved from the nursery the ground at the new site had usually to be soaked in advance and watered frequently following planting. In sections of the ground where hose attachments are available this poses no great problem, but in areas where no pipelines exist water must be transported in tanks, at best a laborious procedure.

Despite these handicaps, a certain amount of out-planting has been accomplished: Some 30 Cotoneasters have been added to our previously established groupings of that genus, near Seven Arches and on the Farm. Sixteen plants of *Viburnum* have been placed on the slope below the Baxter Memorial, and members of other genera, such as *Cornus, Deutzia* and *Euonymus* have been moved to their permanent positions on the grounds.

Our greatest achievement, however, has been the treatment of the north meadow, south of Northwestern Avenue. This area is traversed by a small stream which, on the occasion of heavy rainfall is capable of overflowing its banks and converting the entire region into a muddy lake with a high erosional potential. Although we have almost forgotten what a "heavy rainfall" looks like, we are fairly confident that one day it will rain hard again and much fine top soil will be washed down into the Wissahickon Creek.

The obvious solution of such a problem is to plant the area with moisture-loving or at least moisture-tolerant species of trees and shrubs such as willows, alders and birches and it is for just such a purpose that we have been raising plants of this kind in our nursery. This year many of them were considered sufficiently large to be set out in the meadow. As this issue goes to press 85 birches, representing nine different species of *Betula,* have been put in place. It is believed that as they mature their vari-colored barks will create a pleasing effect and their roots will help to hold the soil at times of severe flooding.

The next group to receive attention was the alders. Over 40 plants of *Alnus,* belonging to five different species, have been planted in lower, damper ground to the west of the birches. The result should be an attractive alder thicket in a naturalistic setting and a real step forward in the control of erosion.

The Fourth Barnes Lecture

The fourth in the series of Laura L. Barnes Lectures on Botany and Horticulture will take place in the auditorium of the Springside Upper School on Wednesday, April 13, 1966. The speaker will be Dr. Walter H. Hodge who is Head of the Environmental and Systematic Biology Section of the National Science Foundation. Dr. Hodge will lecture on some aspects of tropical botany a field in which he is an acknowledged authority. Further details concerning this event will appear in the next issue of the Bulletin.

J. M. F., Jr.

Book Review

A Garden of Trees and Shrubs. Practical Hints for Planning and Planting an Arboretum. By Fred Lape, with a Foreword by John M. Fogg, Jr. Cornell Univ. Press, Ithaca, N.Y. 1965. $7.50.

The subtitle of the book under review explains more exactly the nature of this book. It gives in 14 chapters full directions on establishing an arboretum. The early phase of arboretum-building is covered by chapters (1), First steps: What to do and what not to do; (2), Buying, collecting and planting; and (3) Hazards of the early years. Maintenance and services are discussed in chapters (4), Buildings and Equipment (5), Records, maps and labels; and (6), Preparing for the public. Plants and plantings are dealt with under chapters (7), Conifers worth planting; (8), Broad-leaved evergreens; (9), Rhododendrons and Azaleas; and (10), Deciduous Trees and Shrubs. Some special collections include chapters (11), A Spring Bulb garden; (12), A Collection of Native Bonzai; and (13), School Arboretums and School Forests. It ends with chapter (14), The Later years of an arboretum. An appendix gives useful lists on (A), Books, (B), Plant materials, (C), Nurseries and other sources of plant materials, (D), Equipment, and (E), Organizations.

The word arboretum means literally a garden of trees. As is it known today, the scope of an arboretum is broadened to include all woody plants, trees as well as shrubs and vines. This is the major difference between it and a botanical garden, as the latter includes herbaceous plants. However, herbaceous plants are not purposefully or deliberately excluded by most arboretums and special collections such as wild flowers or drug plants which include many or mostly herbaceous plants are often maintained.

Because the arboretum contains primarily woody plants it is simpler and more economical to maintain than a botanical garden. This is the major reason why in America arboretums are more common than botanical gardens. Especially in recent years, along with increasing recognition of the importance of nature conservation, more and more arboretums, large and small, public and private, are being established all over the country. This is a most commendable trend and should be enthusiastically encouraged.

In this book the necessary procedure on how successfully to establish an arboretum is summarized in a very informative way. The directions given are concise and practical, as they have mostly grown out of the actual experience of the writer as Director of the George Landis Arboretum, Esperance, N. Y. Mr. Lape has written a very useful book, one that will be of help to many people. I would like to quote Dr. John M. Fogg, Jr., in his enlightening foreword to this book: "Lape's book should have a universal appeal. For the established arboretum it should prove immensely valuable. For the college, school, or civic group that is contemplating the establishment of an arboretum, it should constitute an indispensable guide. But perhaps its widest audience will be among landowners who wish to improve their property and to increase the variety and enhance the quality of their plantings."

H. L. Li

Biochemical Studies in Magnolia II. Leucoanthocyanins in Leaves

Frank S. Santamour, Jr.

Leucoanthocyanins are, as the name implies, colorless compounds that are structurally related to the anthocyanin pigments. They may occur as monomers, and possess a certain amount of growth-promoting activity (Stewart and Shantz, 1959) or they may be linked in polymeric combinations to produce condensed tannins (Hergert, 1960). Upon acid hydrolysis, some monomeric and polymeric leucoanthocyanins are converted to colored anthocyanidins (aglycones) which are indistinguishable from the aglycones of similar anthocyanins. Other leucoanthocyanins are known which have no counterpart among the anthocyanin aglycones.

The most common leucoanthocyanin is leucocyanidin. Leucodelphinidin has also been noted in a number of species and leucopelargonidin has been isolated from such diverse sources as Eucalyptus gum and flowers of *Impatiens*. Although leucoanthocyanins may occur in the same tissue as methylated anthocyanins (e.g. peonidin), no methylated leucoanthocyanins have been positively identified in nature.

The occurrence of leucoanthocyanins is much more common in woody than in herbaceous plants. Bate-Smith and Lerner (1954) considered leucoanthocyanins to be part of a primitive metabolic system that was strongly related to, but not essential for, a woody growth habit. The Magnoliaceae are generally believed to be among the most primitive of the angiosperm families. However, the leucoanthocyanins of relatively few species of *Magnolia* have been investigated.

Bate-Smith (1954) reported a weak cyanidin reaction from the leaves of *Magnolia denudata* Desrouss. This species was given a "moderate" reaction rating by Bate-Smith and Lerner (1954), who also reported on the cyanidin reactions of *M. virginiana* L. (weak), *M. stellata* (Sieb. & Zucc.) Maxim. (*negative*), and *Liriodendron Tulipifera* L. (strong).

The purpose of the present study was to determin the existence and types of leucoanthocyanins in the leaves of a large number of *Magnolia* species.

Mature leaves were collected from specimen trees during August, 1965. Two grams of fresh leaf tissue (excluding midrib) were hydrolyzed by boiling in 2N HCl for 40 minutes. The resulting solutions were cooled, filtered, and extracted with 10 ml. of isoamyl alcohol. The alcohol layer was washed twice with 1% HCl and a five-fold volume of benzene added. The benzene-alcohol mixture formed a one-phase system. When more 1% HCl was added, the pigment appeared in the aqueous layer. The purified pigment was recovered from the aqueous solution by extraction with isoamyl alcohol. The anthocyanidins were identified by paper chromatography in Forestal solvent and by their absorption spectra (Santamour, 1965).

Of the 15 *Magnolia* species investigated, only five produced the aglycone cyanidin upon acid hydrolysis. These were *M. Ashei* Weatherby, *M. denudata*, *M. macrophylla* Michx., *M. stellata*, and *M. tripetala* L. The ten species giving negative reactions were *M. acuminata* L., *M. cordata* Michx., *M. Fraseri* Walt., *M. grandiflora* L., *M. Kobus* DC, *M. liliflora* Desrouss 'Nigra', *M. obovata* Thunb., *M. salicifolia* (Sieb. & Zucc.) Maxim., *M. Sieboldii* K. Koch, and *M. virginiana*. The tulip poplar, *Liriodendron Tulipifera*, also gave a positive reaction.

Thus, it appears that the distribution of the "primitive" leucoanthocyanins in the primitive genus *Magnolia* is more or less at random. Species testing both positive and negative for cyanidin were found in both subgenera, among both American and Asiatic species, in species possessing and lacking floral anthocyanins, and at different levels of ploidy. On this basis, the distribution of leucoanthocyanins at the intrageneric level is of doubtful systematic value.

According to Alston and Turner (1963), "Genes affecting leucoanthocyanins are known". The determination of leucoanthocyanins in several *Magnolia* hybrids suggests that the gene (s) for leucoanthocyanin production are at least partially dominant. Among hybrid cultivars derived from crosses between diploid species, where one parent tested positive and the other negative for cyanidin, leucocyanidin was detected in *M. Loebneri* 'Merrill' (*M. Kobus* × *M. stellata*) and *M.* × *Thompsoniana* (*M. tripetala* × *M. virginiana*). Another diploid hybrid, *M.* × *Proctoriana* (*M. salicifolia* × *M. stellata*), did not yield cyanidin.

Three cultivars of the hybrid group *M.* × *Soulangiana* (*M. denudata* × *M. liliflora*) were also tested. Specimens of 'Alexandrina' and 'Alba' gave positive reactions while an individual of 'Lennei' gave a negative reaction.

In all of those hybrid cultivars which have arisen spontaneously in the wild or in botanical gardens, it is practically impossible to determine to which generation the types in cultivation belong. Thus while some hybrids may represent a true first hybrid (F_1) generation, others may belong to the segregating F_2 generation or may even be the result of backcrossing to one of the parental species. It is suggested that leucoanthocyanin production in *Magnolia* leaves is a dominant character and that the above-mentioned hybrids lacking this trait were not members of the F_1 generation. An accurate determination of the mode of inheritance and the number of genes involved in leucocyanidin production will depend on further breeding experiments.

One further point that should be mentioned was the presence of a spot on the chromatograms of all cyanidin-positive species corresponding in Rf value to peonidin. This spot faded rapidly as the paper dried. Although, as mentioned before, no leucopeonidin has previously been identified, Bate-Smith (1954) reported similar results in some species of the Rosaceae and Leguminosae. Furthermore, he noted a "pink-ish-brown trail" in the peonidin region on chromatograms of leaf extracts of species of *Populus, Fagus,* and other genera. The question of the existence of leucopeonidin and other methylated leucoanthocyanins deserves further study.

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New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since September, 1965:

Mr. Harold Blake, Jr.

Mr. & Mrs. G. V. Cass

Mr. & Mrs. Russell C. Clayton

Mr. Eugene E. Cline

Dr. J. Frederick Herbert

Mrs. Adolph A. Hirstius

Dr. William J. Hitschler

Mr. John Irion

Mrs. Herbert V. Kelley

Mrs. Wm. Justice Lee

Dr. Robert S. Munger

Mr. John E. Murphy

Dr. Carl H. Phetteplace

Mrs. J. Pancoast Reath

Mrs. Byron T. Roberts

Mrs. Marc C. Schoettle

Mrs. Edward Starr, III

Mr. Thomas A. Todd

Mrs. Elizabeth B. Wheeler

Mrs. George M. Williams

Mr. & Mrs. Jack Zankman

The Oldest Living Plants

J. J. Willaman

We humans like to establish the superlatives in everything — the biggest, the fastest, the hardest and so on. In the plant world we have tried for many decades to establish the oldest individual. This has not been easy. We must depend entirely on circumstantial evidence, since the beginning of many individual plants goes far back of any historical records. As we shall see, the contenders for being the oldest thing are in the western hemisphere and here any historical records are of comparatively trivial age.

The most useful and accurate way of measuring the age of a tree is, of course, to count the annual rings. Although there are some pitfalls in the method it is in general reliable. It is the basis of the science of dendrology developed over some decades in the southwestern area of this country by Dr. D. A. Douglass of the University of Arizona (Schulman, 1958). Using trees of known age and comparing the width of the bands with the known amount of annual rainfall during the life of the tree he established that wider bands occurred during years of higher water supply and narrower bands during years of lower water supply. The relation is good in the semiarid southwest where apparently rainfall is the critical factor for growth. In more humid areas other factors come into the picture and the system is untrustworthy. The irregular sequence of rainfall was reflected in a sequential pattern of widths of annual rings. By comparing patterns of trees of known age with the patterns in the beams of cliff dwellings of overlapping age he set up a calendar by means of this system of dendrochronology.

Cypress of Tule

This specimen of Mexican cypress (*Taxodium mucronatum* Ten., closely related to the bald cypress, *T. distichum* (L.) Rich.) is growing in the Indian village of Santa Maria del Tule, near the city of Oaxaca (Randall and Edgerton, 1939). It is a huge tree, only about 118 feet tall but with a trunk diameter of about 36 feet. The cross section contour of the tree is so extremely irregular, however, that the true diameter and girth are difficult to assess. In fact, some botanists think that there has been a fusion of three trunks. For these reasons the age has been variously estimated as 4000 to 10,000 years.

Sierra Redwood

Sequoiadendron giganteum (Lindl.) Bucholz is not as tall as the coast redwood, *Sequoia sempervirens* (Lamb.) Endl., but it is more massive. Probably the best known, and possibly the most massive, of the Sierra redwoods is the General Sherman tree in the Sequoia National Park. Its statistics are impressive — 272 feet high, 32 feet in diameter breast high, total weight of both above ground parts and roots 6000 tons, diameter of root spread 400 feet, first branch 130 feet from the ground and 6 feet in diameter (Baker, 1943). When it comes to its age the data are not so accurate. The coring instruments

Fig. 50. Leaves of *Gaylussacia brachycera*.

used to get a sample along the radius of a tree cannot reach the center of General Sherman, even if it were permitted. The best estimates from nearby fallen trees are 3000 to 4000 years.

Bristlecone Pine

By the 1950's Dr. Douglass had pushed his tree ring calendar back to about 700 A.D. He was still not satisfied, of course, and enlisted the services of Dr. Edmund Schulman (Schulman, 1958). He searched the trees of the western mountains, examined hundreds of specimens of many species, and finally reached the working hypothesis that the oldest trees were those living under difficult conditions of moisture supply and that the patterns of their minute rings showed high sensitivity to varying rainfall. In the White Mountains of California they found many old, gnarled and worn specimens of *Pinus aristata* Engelm. Many were 4000 years old, and the one they came to call Granddad was 4600 (Schulman, 1958). Among trees, at least, this bristlecone pine is probably the oldest individual plant.

Box Huckleberry

This contender for the title of oldest plant is not a tree. It is a low, evergreen, ground-covering shrub, with edible fruits like huckleberries and leaves like box. It is variously called box huckleberry, ground huckleberry, bear huckleberry, but *Gaylussacia brachycera* (Michx.) Gray by botanists. (Cover and Figs. 50 and 51).[1] Its occurrence is extremely limited: Pennsylvania, Delaware, Maryland, Kentucky, and Tennessee having two or three locations, and Virginia and West Virginia having a few hundred in one area. (Wherry, 1934).

The species has been known since about 1790 (Adams, 1949). In 1845 a specimen, about 8 acres in extent, was discovered in Perry County, Pennsylvania. It did not attract any particular attention until 1918, when Dr. F. V. Coville made extensive studies and came to the conclusion that this "colony" is actually a single plant. It extends itself by stolons at the rate of some six inches a year. Calculation showed that this plant is about 1200 years old. Then in 1920 another plant was discovered along the Juniata River a few miles from the first one. It extends for 1¼ miles along the northern slope of a mountain. The estimate of its age is a startling 13,000 years.

Now for the inevitable question, "What is the evidence that these apparent colonies are indeed just individual plants?" There are four lines of argument (E. T. Wherry, personal communication):

[1] Cover and Fig. 50 by Patricia Allison; Fig. 51 by Ruth McV. Allen.

Fig. 51. Flowers of *Gaylussacia brachycera.*

1. By and large over the whole area the stolons radiate from a center.
2. Seedlings are extremely rare, occurring only where two plants are close enough for cross pollination. This indicates self-sterility. It was proved by taking pollen from a Pennsylvania plant and placing it on flowers in Delaware. Some vigorous seedlings were obtained.
3. The plant never straddles a stream or a wash because the stolons can't cross and there are no seedlings to grow on the other side.
4. There is unusual uniformity in size and shape of leaves and fruit. A true colony made up of seedlings would have much more heterogeneity.

In conclusion: it is almost a toss-up among the three tree species as to which contains the oldest living individual because of some uncertainties, but *Pinus aristata* with its Granddad tree at 4600 years is probably the winner. But if we accept the lines of evidence for *Gaylussacia brachycera,* no doubt the oldest living single plant is the 1¼ mile long box huckleberry, with 13,000 years. It is possible that there was no human being in Pennsylvania when that plant started out.

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Associate's Corner

Chests for Patents and Patients

One of our main prides and joys in the Arboretum is the Medicinal Garden. In connection with this, from time to time, we add books, pictures, and other paraphernalia pertaining to the ancient practices of herbal materia medica.

Recently we have been presented with a very complete little medicine chest. It contains scales, weights, a small mortar and pestle and even includes some of the old powders in the bottles. I tried to find out something about the chest's history, but the dealer from whom it was purchased could not even remember where he got it.[1]

In the good old days physicians were their own chemists and concocted their own prescriptions, carrying such a chest with them in their buggy on their calls from house to house. It would be interesting to know something of our chest's peregrinations and the patients visited. In my research it turned out that medicine chests were so ordinary nothing has been written about them that I know of, but I did run across some other tasty bits.

Back in 484 B.C. Herodotus complained that there were too many specialists in the medicinal profession. "Each physician is a healer of one disease and no more . . . eyes, teeth, ears . . . some of what pertains to the belly and some of the hidden diseases."

We Americans, of course, had to go one better and at County Fairs, etc. in Victorian days, fakers sold bottles of so-called secret medicines guaranteed to cure everything from tuberculosis and epilepsy to pains from a broken leg. The claims those fellows made make our modern miracle drugs appear positively puny. Perhaps paying $2.00 for a bottle of colored tap water did have some therapeutic effect on many, for there was a big demand, or maybe it was the strong dose of added whiskey which many contained.

In 1870 a D. S. Cadwallader of Philadelphia advertised "Mystic Water from David's Well" as a sure Cure-All. The contents are reputed to have come from the farm of a David B. Taylor near Bristol, Pa. As there was a famous Spa in the neighborhood, they could have really had some medicinal values.

The term "patent medicine" came from Patents of Royal Favor granted by Kings in the early 18th century. The first medicinal product patented in England 1722 bore the impressive title Stoughtan's Great Cordial Elixir and is still listed in the U. S. Pharmacopoeia as Compound Tincture of Gentian, which brings us back to our Medicinal Garden, for gentians flourish happily there.

Marion W. Rivinus

[1] The author of this account has modestly refrained from stating that it was she who presented this chest to the Arboretum. Ed.

Course in Plant Breeding

Beginning on Thursday, January 13, 1966, Dr. Santamour will offer a ten-lecture course in Plant Breeding for Associates and friends of the Arboretum. This course will assume no previous background in genetics or plant breeding, and although designed for a practical level, will include the basic aspects of genetics that are necessary for a full understanding and appreciation of the art of plant breeding.

Among the topics to be developed are: History of Plant Breeding, Chromosomes and Genes, Patterns of Inheritance, Chemistry and Inheritance of Flower Color, Pollination Systems, Hybrid Vigor, Methods of Controlled Pollination, as well as special emphasis on particular genera or plant groups as determined by the interest of the class members.

The class will meet on Thursdays at 10:00 A.M. from January 13 through March 17 in Gates Hall at the Morris Arboretum, 9414 Meadowbrook Avenue. The lecture-discussion period will be one hour in length. Fee for this course is $15.00. Those interested should call Chestnut Hill 7-5232 or write to the Morris Arboretum, Philadelphia 18, Pa.

Library Accessions

The following are among the items added to the Library during 1965:

American Men of Science, 11th Ed. Part I: A-C. R. R. Bowker Co. New York. 1965.

Biogeography of the Southern End of the World. P. J. Darlington, Jr. Harvard Univ. Press. 1965.

Biology of Plant Parasitic Nematodes. H. R. Wallace. Edward Arnold Ltd. London. 1963.

Blumen-Paradiese der Welt. Herbert Reisigil. Umschau Verlag, Frankfurt am Main. 1964.

Bonsai: Trees and Shrubs. Lynn R. Perry. Ronald Press. New York. 1964.

Botanical Histochemistry. W. A. Jensen. W. H. Freeman. San Francisco. 1962.

Cacti and Succulents. W. Haage. E. P. Dutton. New York. 1963.

California Desert Wildflowers. P. A. Munz. Univ. California Press. 1962.

California Spring Wildflowers. P. A. Munz. Univ. California Press. 1961.

Check List of Plant and Soil Nematodes. A. C. Tarjan. Univ. Florida Press. 1960.

Chromosome Atlas of Flowering Plants. C. D. Darlington & A. P. Wylie. Hafner Publ. Co. New York. 1961.

Common Trees of Puerto Rico and the Virgin Islands. E. L. Little, Jr., & F. H. Wadsworth. U. S. Dept. Agr. Handbook No. 249. Washington. 1964.

*Cultivation of Animal and Plant Cells. Philip R. White. 2nd Ed. Ronald Press. New York. 1963.

Dictionary of Terms in Pharmacognosy. G. M. Hocking. Chas. C. Thomas. Springfield, Ill. 1955.

Flora Europaea. Vol. 1. Lycopodiaceae to Platanaceae. Ed. T. G. Tutin et al. Cambridge Univ. Press. 1964.

Flora of New Hampshire. A. S. Pease. New England Bot. Club. Cambridge, Mass. 1964.

Garden of Trees and Shrubs. Practical Hints for Planning and Planting an Arboretum. Fred Lape. Cornell Univ. Press. Ithaca, N.Y. 1965.

Geography of the Flowering Plants. Ed. 3. R. Good. John Wiley & Sons. New York. 1964.

**Glossary of Botanic Terms. B. D. Jackson. 4th Ed. G. Duckworth & Co. London. 1960.

Guide to Plants of the Everglades National Park. A. D. Hawkes. Tropic Isle Publ. Coral Gables. 1965.

Guide to the Vascular Flora of the Carolinas. A. E. Radford, H. E. Ahles & C. R. Bell. Univ. North Carolina Press, Chapel Hill. 1964.

Handbook of North Dakota Plants. O. A. Stevens. North Dakota Institute for Regional Studies. 1963.

Hardy Heaths and some of their nearer Allies. A. T. Johnson. Blanford Press. London. 1956.

Heather Garden. F. P. Chapple. Collingridge Ltd. London. 2nd Ed. 1964.

Men with Green Pens. Louise Bush-Brown. Dorrance & Co. Philadelphia. 1964.

Native Vegetation of Nebraska. J. E. Weaver. Univ. Nebraska Press. Lincoln. 1965.

Palms of the World. J. C. McCurrach. Harper & Bros. New York. 1960.

***Proceedings International Conference on Plant Tissue Culture. Ed. by P. R. White and A. R. Grove. McCutchan Publ. Corp. Berkeley. Calif. 1965.

Revision of the genus Camellia. J. R. Sealy. Royal Hort. Soc. London. 1958.

Roadside Flowers of Texas. Howard S. Irwin. Univ. Texas Press. Austin. 1961.

****Selected Guide to the Literature on the Flowering Plants of Mexico. Ida K. Langman. Univ. Pennsylvania Press. 1964.

Trees and Shrubs of the Upper Midwest. C. O. Rosendahl. Univ. Minnesota Press. Minneapolis. 1963.

*Gift of the Author
**Gift of Mrs. Edmond G. Thomas
***Gift of Dr. P. R. White
****Gift of the Author

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Elliottia racemosa

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THE ASSOCIATES, through whose interest and generosity *The Bulletin* and certain other undertakings of the Arboretum are made possible, is an informal group of individuals interested in encouraging and furthering the educational and research endeavors of the Morris Arboretum.

CLASSES OF MEMBERSHIP

Contributing	$ 5.00 a year	Supporting	$ 25.00 a year
Sustaining	$10.00 a year	Sponsoring	$100.00 a year
Donor	$500.00		

Arboretum Activities

THE STAFF

The Director and his wife spent three weeks in Mexico in December and January. This trip provided an opportunity to visit the recently established Botanical Garden of the National University of Mexico as well as to photograph and collect plants in a wide diversity of habitats.

On January 18 Dr. Fogg gave an illustrated lecture entitled "Some European Botanical Gardens", before the Philadelphia Society of Little Gardens. This talk was repeated at the Tennessee Botanical Garden at Nashville on February 18.

On February 8 he lectured on "The Morris Arboretum - Botanical Treasure House" in the Philadelphia Academy of Natural Science's 1966 Seminar for Outdoorsmen and on February 14 he spoke to the Penn Valley Garden Club on the subject, "Plants are Travelers". At an evening meeting of the Pennsylvania Horticultural Society on March 8 he gave an illustrated lecture on "The Trees of Fairmount Park."

During the spring term Dr. Li is giving an undergraduate course on the Systematic Study of the Flowering Plants and Dr. Allison is con-

(*Continued on Page 14*)

The Heath Garden of the Morris Arboretum

John M. Fogg, Jr.

The Arboretum's Heath Garden has grown out of a desire to bring together in a rather restricted area nearly all of the members of the Ericaceae or Heath Family which are hardy in this area. I say "nearly all" because the genus *Rhododendron* (including the Azaleas) is so enormous that several acres have already been alloted to its seemingly limitless array of species, hybrids, varieties and cultivars.

As is well known, the members of the Heath Family, with very few exceptions, prefer or at least will tolerate soils of very low acidity. Individual genera may vary somewhat in their relations to the moisture content of the soil, but the great majority of species occur in dry peaty or sandy habitats. Even those which seem to prefer moist boggy situations such as Labrador tea (*Ledum groenlandicum*) and bog rosemary (*Andromeda glaucophylla*) have succeeded in the environment which we have provided for them. Here, then, is one instance in which a taxonomic arrangement and an ecological grouping appear to coincide.

In the selection of a site for the establishment of our heath collection the primary requisite was one in which the soil was already strongly acid. One can, of course, increase the acidity of most soils by the addition of sand, peat and certain chemicals, but the maintenance of the desired pH is a great deal easier if the medium is at least minim-acid to start with.

Fig. 1. *Elliottia racemosa*

Fig. 2. South section during construction

Another consideration, since many of the plants we wished to grow originated from climatic zones somewhat warmer than ours, was to find a south-facing slope which would provide protection from harsh winds and at the same time allow a high degree of radiation. Still other desiderata were proper drainage and an adequate source of water.

After a careful study of all of these needs, the area which was finally chosen was on a slope just below the walk leading to the Baxter Memorial. Here conditions were believed to be as suitable for our project as any which could be found within the Arboretum.

Early in 1958 we began moving plants from the nursery as well as other sections of the grounds into our new area and by early autumn a score or so had been established; these included, among others, mountain laurel (*Kalmia latifolia*), sheep laurel (*Kalmia angustifolia*), fetter bush (*Leucothoe racemosa*) and two other species of this genus (*L. fontanesianum* (*L. Catesbaei* or *L. editorum*) and *L. axillaris*), stagger bush (*Lyonia mariana*), privet andromeda (*L. ligustrina*) and evergreen privet andromeda (*L. lucida*), leatherleaf (*Chamaedaphne calyculata*), Japanese andromeda (*Pieris japonica*) and Alleghany andromeda (*P. floribunda*), redvein Enkianthus (*Enkianthus campanulatus*) and white Enkianthus (*E. perulatus*), zenobia (*Zenobia pulverulenta*), sparkleberry (*Vaccinium arboreum*) and several other species

Fig. 3. *Calluna vulgaris* var. *hirsuta*

of blueberries (*Vaccinium* spp.), and four species of huckleberries (*Gaylussacia* spp.)

Our most distinguished accession that year was a pair of specimens of *Elliottia racemosa* sent to us in November by Dr. Fred Nisbet who was at that time Superintendent of the famous Biltmore Gardens at Asheville, North Carolina. (See Cover and Fig. 1) I had seen this rare member of the Ericaceae when the American Association of Botanical Gardens and Arboretums met in Asheville in August, 1958, and had asked Dr. Nisbet if he could let us have a small plant or a rooted cutting; instead he sent us two specimens about 8 feet tall!

During the next four or five years we continued to add to the number of species in our modest collection. Some of these were collected in the wild by members of the staff. These included sand myrtle (*Leiophyllum buxifolium*) and bearberry (*Arctostaphylos uva-ursi*) from the Pine Barrens of New Jersey, as well as several additional species of *Vaccinium* and *Gaylussacia*. We even collected for planting in the garden a few plants, such as sweet fern (*Comptonia peregrina*), Conrad's crowberry (*Corema Conradii*), and Pine Barren Hudsonia (*Hudsonia ericoides*) which, while not members of the Ericaceae, are so frequently associated with them in their natural habitat that we consider their inclusion in this collection entirely appropriate.

We were fortunate in obtaining from the University of Washington Arboretum as well as from the Arnold Arboretum a very fine Oriental blueberry (*Vaccinium Oldhami*), a native of Japan and Korea, and from the Holden Aboretum in Mentor, Ohio, material of the rather localized genus *Menziesia*. A few plants, such as the sourwood or lily-of-the-valley tree (*Oxydendron arboreum*), of which we had no specimens suitable for moving, were obtained from nurseries.

Fig. 4. South section in September, 1963

Fig. 5. North section during construction

It will be noted that up to this time no mention has been made of true heather (*Calluna*) or the true heaths (*Erica*). Actually, we had a considerable number of these small evergreen and highly colorful Ericads in our greenhouses and cold-frames, but we realized that they required somewhat different conditions than those presented on the slope where practically nothing had been done to improve the residual soil. Also, we had been adding to our representation of other genera at such an increasing rate that the originally designated area was no longer considered adequate.

Accordingly, during the summer of 1963 we removed a dense tangle of yews and junipers from a strip immediately down the slope and to the south of our Heath Garden and began to prepare it for planting. This was accomplished by bringing in many loads of leaf-mold and peat, placing larger boulders to create natural-

Fig. 6. North section in August 1965

istic contours, and the laying down of walkways and steps. (Fig. 2). That autumn most of the smaller shrubs which had originally been planted in the upper (north) section were removed to the recently prepared site and a considerable variety of new plants was added, including several cultivars of *Calluna* (Fig. 3) and a number of species and forms of *Erica*. (Fig. 4).

Once the older or north section of the garden was vacated we began to prepare it for improvement and expansion. Again, this involved building up and contouring the terrain by the addition of soil and boulders, as well as the laying out of walkways. (Fig. 5). Here we were desirous of giving greater relief to the surface, creating hummocks as well as depressions, the latter to provide pockets for the less hardy forms of heaths and heathers.

By November the task was largely completed and the newly prepared and greatly enlarged section was permitted to "settle" during the winter of 1964-65. At this juncture, it may be noted, our Heath Garden consisted of two areas of unequal size, one an upper (north) section separated from a lower (south) section by a grassy walk which leads on down the south slope toward the Swan Pond.

Fig. 7. *Gaultheria Shallon*

It is a very real pleasure at this point to acknowledge the important role which our Superintendent, Mr. John Dourley, has played in the creation of this garden. It is due largely to his skill and imagination that this project has been carried forward to completion.

In the spring of 1965 transplanting into the new section began. As previously indicated, a few forms of *Calluna* and *Erica* had already been installed in the older area, but these were as nothing compared to what now took place, thanks to the energy and enthusiasm of one of our volunteer workers, Mrs. Mark F. Emerson. As a result of numerous trips to nurseries and private collections on Cape Cod, Long Island and elsewhere, she had amassed an impressive and highly selective assemblage of these plants

Fig. 8. *Bruckenthalia spiculifolia*

for our growing collection. The result is that our embryonic Heath Garden now contains 58 cultivars of *Calluna vulgaris* and 12 species as well as 4 hybrids and over 40 cultivars of *Erica*. It is expected that in a future issue of the Bulletin Mrs. Emerson will favor us with a detailed account of this complex and highly variable group of plants. For that reason no enumeration of them is presented at this time. (Fig. 6).

Various other friends, learning of our undertaking, have donated specimens of rare or unusual plants. Two fine specimens of box huckleberry (*Gaylussacia brachycera*) were a gift from Dr. J. J. Willaman, whose account of this species appeared in the Bulletin for December, 1965. (Volume 16, No. 4). Mr. Philip A. Livingston, our publisher and a real heather enthusiast, gave us a magnificent plant of the southern *Vaccinium crassifolium*. To the Don Smiths of the Watnong

Nurseries at Morris Plains, New Jersey, we are indebted for beautiful material of the bog rosemary (*Andromeda glaucophylla*) as well as a number of other specialties which will be planted out in the spring of 1966. Mr. and Mrs. E. Perot Walker have presented us with a plant of the creeping snowberry (*Gaultheria (Chiogenes) hispidula.*)

To acknowledge the generosity of one nurseryman without naming all the others who have given us valuable material, would seem to be invidious. Nevertheless, we can not refrain from expressing our deep gratitude to Mr. Henry J. Hohman, of Kingsville Nurseries, Maryland, who has given us so many rare and beautifully grown specimens.

Although our venture is a relatively new one, it does not seem to us premature to call attention to the performance of a number of species which have surprised everyone. Foremost among these, perhaps, is the western American salal (*Gaultheria Shallon*), several clumps of which have not only survived two winters, but have spread aggressively and flowered during the summer of 1965. (Fig. 7). Another has been the mountain cranberry (*Vaccinium Vitis-Idaea* var. *minus*), which flowered and fruited last summer and autumn.

Irish heath (*Daboecia cantabrica* and its var. *alba*) appears to be comfortably established, as does the rather unusual little spike heath (*Bruckenthalia spiculifolia*), (Fig. 8) a native of southeastern Europe and Asia Minor.

We still have our reservations about several species of *Pernettya,* a South American genus seldom seen in cultivation in this area, and we should consider it a real triumph if *Cassiope hypnoides,* which flowered last summer, should survive the winter. To date we must confess complete failure in our attempts to grow the southern European strawberry-tree (*Arbutus Unedo*); but we plan to repeat our efforts to cultivate it.

Two common eastern American subshrubs, namely, trailing arbutus (*Epigaea repens*) and wintergreen or teaberry (*Gaultheria procumbens*) give every indication of being adjusted to their new surroundings and doubtless our success with these, as with several of the foregoing, will depend upon our ability to maintain a strongly acid soil.

As already indicated, limitations of space in general prevent the inclusion of the genus *Rhododendron* in our Heath Garden. We have, however, made an exception in the case of a few small and rather choice species. These include *R. Degronianum, R. impeditum, R. linearifolium, R. minus* and *R. myrtifolium.* A few others will be added in the future in order that this, the largest genus in the Ericaceae, may be accorded at least a token representation.

Although by strict definition, a Heath Garden should include only members of the Ericaceae, we have, as previously mentioned, added a few species which in the wild occur in similar habitats. This group includes such plants as black crowberry (*Empetrum nigrum*), partridge berry (*Mitchella repens*), cliff-green (*Pachistima Canbyi*), a trailing St. John's-wort (*Hypericum olympicum*) and several dwarf or prostrate species of Genista, such as *G. sagittalis.*

To lend variety and accent to the planting, we have also included a couple of birches and several low-growing conifers, such as *Thujopsis dolbrata* var. *nana.* Throughout this undertaking our chief objective has been to create a garden which would be both aesthetically pleasing and educationally significant.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since December, 1965:

Mrs. Huston B. Almond
Mrs. Lucius F. Deming
Mr. K. D. Gummer
Mr. Robert G. Hoffer
Mr. and Mrs. Joseph N. Janney
Mrs. F. Allen Lucy
Mrs. James W. Marvin
Mrs. Edwin F. Nimmo
Mrs. Albert H. Rosengarten
Mrs. E. Leslie Snow
Mr. Evert Vis
Mr. John R. Wicoff

Variations in the Sweet Bay Magnolias

Joseph C. McDaniel

As a horticulturist who since 1961 has been following Oliver Freeman (1937) and others in hybridizing *Magnolia virginiana* L. with several other American species, I have observed major and minor variations among both wild and cultivated plants commonly referred to this species. My conclusion is that none of the horticultural or botanical articles I have read, not even the generally good recent treatment by Mr. J. E. Dandy (1964), gives quite the complete situation seen in these Magnolias. A probable separation into three varieties (or possibly even into two species) of the American sweet bay Magnolia trees seems the most reasonable disposition after studies with flowering trees of them from different sources, wild and cultivated. Some characters, overlooked by Sargent and others who have studied primarily herbarium materials, need inclusion in the description of var. *australis,* which then is seen to be well separated from other taxa.

Sargent (1919) published *M. virginiana* var. *australis,* which Ashe (1931) later raised to specific rank, for the more pubescent, more persistent-leaved, generally larger-growing tree occurring from the vicinity of Wilmington, N. C. to southern Florida and near the coast at least to Hardin County, Texas (Lowrey, 1965.) Its known range was extended inland by Sargent (1922) to Hot Spring County, Arkansas, and I have further identified the trees of outposts in both eastern and western Tennessee (Polk and

Fig. 9. *M. virginiana* var. *australis* and Lynn Lowrey. San Jacinto County, Texas

Fig. 10. *M. virginiana* var. *australis* and J. C. McDaniel, Jr., Jasper County, Texas

McNairy Counties) as belonging to this taxon, which evidently ranges farther inland than Sargent had originally supposed. Fernald (1950) had included Tennessee in the range of typical *M. virginiana,* but it does not seem to grow wild there.

The Polk County, Tennessee, outpost, at 1600 feet, may be the highest altitude at which *australis* or any native sweet bay occurs. Its southern limits are in dispute. For its Texas limit of distribution, Sargent (1919, 1922) probably meant Valley of the lower Neches River, where it is still found, but he wrote "Nueces". It occurs along creeks of the San Jacinto drainage, as far west as Montgomery County. In Florida, it occurs in most counties, including the Everglades southwest of Miami, but John Popenoe (1965) can find no evidence of it on the Florida Keys, where Dandy and previous authors place *M. virginiana* or a variety. Both varieties (following Sargent) overlap to some extent in range in eastern Georgia and the Carolinas. Whether var. *virginiana* gets as far south as Florida (various authors) and whether var. *australis* as I redefine it may be found wild sparingly in southeastern Virginia (Fernald, 1950), are details that need further study. (In a cursory survey in 1965, I found only var. *virginiana* in Virginia and south near the coast to Dare County, N. C.) There is general agreement among those who recognize var. *australis* that the typical glabrous and deciduous var. *virginiana* does not occur naturally in the states west of Georgia, and it seems rare even there. Its total

Fig. 11. *M. virginiana* var. *australis* with large persistent leaves. Montgomery County, Texas

native population (in Massachusetts and New York to Georgia) is probably much less than that of var. *australis* in the southern U. S., though var. *virginiana* seems the more common variety in cultivation.

Though Ashe reported seeing no intergrading forms in the coincident range of the typical "Northern" *M. virginiana* and his *M. australis,* there are in cultivation in Britain (Dandy, 1964) and in America many somewhat ambiguous specimens. These, as I have seen them, agree with or approach var. *australis* principally in their persistence of pubescence (on shoots, pedicels and leaf parts) and in tending to open their flower buds rather late in the afternoon, but are uniformly much more like the typical *M. virginiana* in some of the characteristics (autumn-deciduous leaves, shrub or small tree stature, and the usual leaf shapes) mentioned by Sargent and Ashe, and in several other characteristics, not previously mentioned in the literature, in which I have observed consistent differences between the northern and southern sweet bay Magnolias. Expand Sargent's too-brief description of var. *australis* to include these other rather fundamental differences I have observed where it is cultivated in the same locality with typical *M. virginiana* (particularly items 1-4 below), and it should, I believe, be recognized at least as a separate variety, if not a species. I consider the "intermediate" uniform enough to be worthy of variety status under *M. virginiana.*

Here are some of the key points of separation:

(1) Var. *australis* has much paler colored pollen than var. *virginiana.* (The "intermediate" plants have pollen like the typical variety.)

(2) Flower odor consistently differs, being more lemon-like in var. *australis.*[1]

(3) Flowering, and apparently vegetative growth, starts three or more weeks later in the spring with var. *australis.*

(4) Var. *australis* flower buds in June open near sundown, about two to five hours later than buds on var. *virginiana,* and close the same evening an hour or two later than those of var. *virginiana.* (Some, at least, of the "intermediate" plants also have bud-opening near sunset.) All day-old flowers re-open and shed pollen the following afternoon, but with a similar time difference between the taxa. In *australis,* at least, flowers can re-close again, before re-opening permanently on the third afternoon.

(5) Fruits of var. *australis* are slower to mature than those of var. *virginiana* and the "intermediates", taking about 90 days from flowering time, compared to 70 days for the others.

(6) Var. *australis* usually has one or a few trunks dominant and rather erect, with a crown spread, even when open-grown, usually less than half the tree height. Var. *virginiana* and the intermediates have more tendency toward a multi-stemmed condition, with diverging trunks and a total crown spread often greater than half their height.

[1] Chemical studies, as by chromatography, following Santamour (1965), are planned to analyze these color and odor differences.

Fig. 12. Multi-petaled flower on a *M. virginiana* tree at Mount Pulaski, Illinois

"Evergreen" leaves probably will not always separate the taxa. Though flowering-age var. *australis* specimens, at such locations as Swarthmore and Brookville, Pennsylvania, and in central Illinois, all well north of their natural range, have been more evergreen than exposed plants of *Pyracantha coccinea* or most plants of *Mahonia Aquifolium,* and though other comparable age *M. virginiana* taxa were more deciduous, leaf retention seems to vary with the site, with the age of plant and apparently to a considerable degree among individual clones within each taxon. In Texas and western Louisiana, most var. *australis* plants were partly deciduous by the end of December, 1965 (Figs. 9 and 10),[2] but an occasional tree retained nearly all its 1965 foliage green (Fig. 11).

Small plants, and young basal suckers of var. *virginiana* and the "intermediate", also tend frequently to hold some leaves green until March or April, particularly southward, so it is not

Fig. 13. Contrasting fruits and leaves of two *M. virginiana* trees. Left: from a tree near Princeton, Illinois. Right: from a multi-stemmed shrub at Champaign, Illinois. (Flowing branches of the latter are shown in Fig. 14)

enough to see retention of one or a few green leaves and conclude, "This is *australis.*" The fresh flowers are a much more certain key. But if the plant is of flowering age, shows dense pubescence on last year's shoots and retains many green leaves on upper branches in March, it probably is *australis,* even if far short of fifty feet tall. A tree that tall or taller almost certainly will be *australis.* (Fig. 18).

No nursery that I know of in America has heretofore offered clonal cultivars of any variety of sweet bay. We need selection of cultivars for different situations. Though *M. virginiana* can be grown from cuttings or layers (and Sargent suggested grafts on the very dissimilar *M. acuminata* for taller and faster growth), most

[2] Photographs by the author.

Fig. 14. Shrubby *M. virginiana,* Champaign, Illinois.

material offered by nurserymen now seems to be miscellaneous seedlings. A few nurseries have propagated seedlings from lines that tended to have a better than average growth habit, or larger flowers, or (with *australis* in Tennessee) more strongly persistent foliage. Some registered cultivars, however, are in prospect for the near future, including probably selections from all three taxa, and perhaps even shrubby ones from var. *australis.* John Popenoe tells me that the shrubs of it reported from south Florida (var. *parva Ashe*) are probably shrubby because of unfavorable sites. I should make the same guess for some plants seen recently northeast of Buna, Texas (Fig. 10). There are some clones under trial here and elsewhere that may remain shrubby even in fertile soils. I have one clone tracing to a nursery source near Lafayette, Louisiana, with very compact growth and small, narrow leaves, but it has not yet been exposed to Illinois winters.

Some clones, at least, of var. *australis* are hardier than Sargent and Rehder (1927) thought,

Fig. 15. The Holden Arboretum's *M. virginiana,* Mentor, Ohio.

Fig. 16. Leaves from a southern Alabama seedling *M. virginiana* var. *australis* (top) and from a compact form of *M. virginiana* grown at Winchester, Tennessee.

succeeding to the northern border of the U.S.D.A. (1960) Zone 6a (average winter minimum temperature -10° to 0° F.) in central Illinois, and one is doing well with David G. Leach at Brookville, Pennsylvania (Zone 5a). This variety, at least in that clone or in another collected from its most northern upland source in Tennessee (Zone 7a), should be more hardy than most forms of *M. grandiflora,* which U.S.D.A. (1960) considers doubtful in Zone 7a. The "intermediate" variety, which one or more nursery sources have distributed widely, though I don't know from what original point, has been observed in floriferous growth at such Zone 5 locations as Lisle, Illinois (Morton Arboretum) and Shenandoah, Iowa, and in Zone 6b to 7a (The Arnold Arboretum and Cairo, Illinois.) From appearances, it should be as hardy as typical *M. virginiana,* which grows well in southern Michigan and at Durham, New Hampshire (Zone 5a). Farther south, say in much of Zones 6 through 8 of U.S.D.A., select clones of all three taxa might be considered for ornamental plantings. Var. *australis* probably excels in far-southern adaptation. It tends to have more evergreen foliage and has (to my nose, at least) somewhat more interesting flower odor, but generally makes a taller tree. The other two offer more picturesque silhouettes and generally better plant size for growing in home landscapes, displaying their flowers and fruits nearer to eye-level. Var. *virginiana* has the most extreme variations I have seen, in flowers, fruits and leaves, among the sweet bays.

One of the prospective cultivar sources in var. *virginiana* with many flowers like that shown in Fig. 12, is in Mt. Pulaski, Illinois. It is the largest-flowered one of a number of survivors among sweet bays distributed there around seventy-five years ago by the Capps Nursery, now out of business. One of his descendants told me that Mr. Capps got his original seeds from trees at the Missouri Botanical Garden, where a somewhat similar, but not quite so multi-petaled old specimen of *M. virginiana* still graces the garden east of the Linnean House. Dr. Edgar Anderson suggests that Henry Shaw would most probably have sent to his native England for sweet bays, which have been cultivated there since 1688, longer than any other *Magnolia.* The Mt. Pulaski trees thus may represent several generations of seed selection.

Clonal propagation has just been started from another *M. virginiana* planted on the Vilas V. Hensel farm near Princeton, Illinois in 1912. It has large flowers for the species, and the most extremely fertile fruits that I have seen in the whole genus. As shown in Fig. 13, these frequently have three seeds per carpel, and sometimes as many as five.

Good sources for shrubby forms of *M. virginiana* include a narrow-leaved plant in Champaign, Illinois (Fig. 14) whose seedlings, under test as far south as Mobile County, Alabama (Zone 9a), have reproduced its dwarf habit. Several began flowering when just over two years old. At the Holden Arboretum *M. virginiana* is represented by a shrubby multi-stemmed plant with broader petals and leaves, which I join several other Magnolia enthusiasts in nominating for cultivar status. (Fig. 15)

Fig. 16 shows the generally retuse leaves of a deciduous *M. virginiana* clone at Winchester, Tennessee, where several similar plants appeared among nursery seedlings obtained originally from New Jersey. This is a compact growing clone, also scheduled for commercial increase and introduction.

Fig. 17. Flower at left is from the same *M. virginiana* tree as Fig. 12. At right is a flowering graft from the Swarthmore clone of *M. virginiana* var. australis.

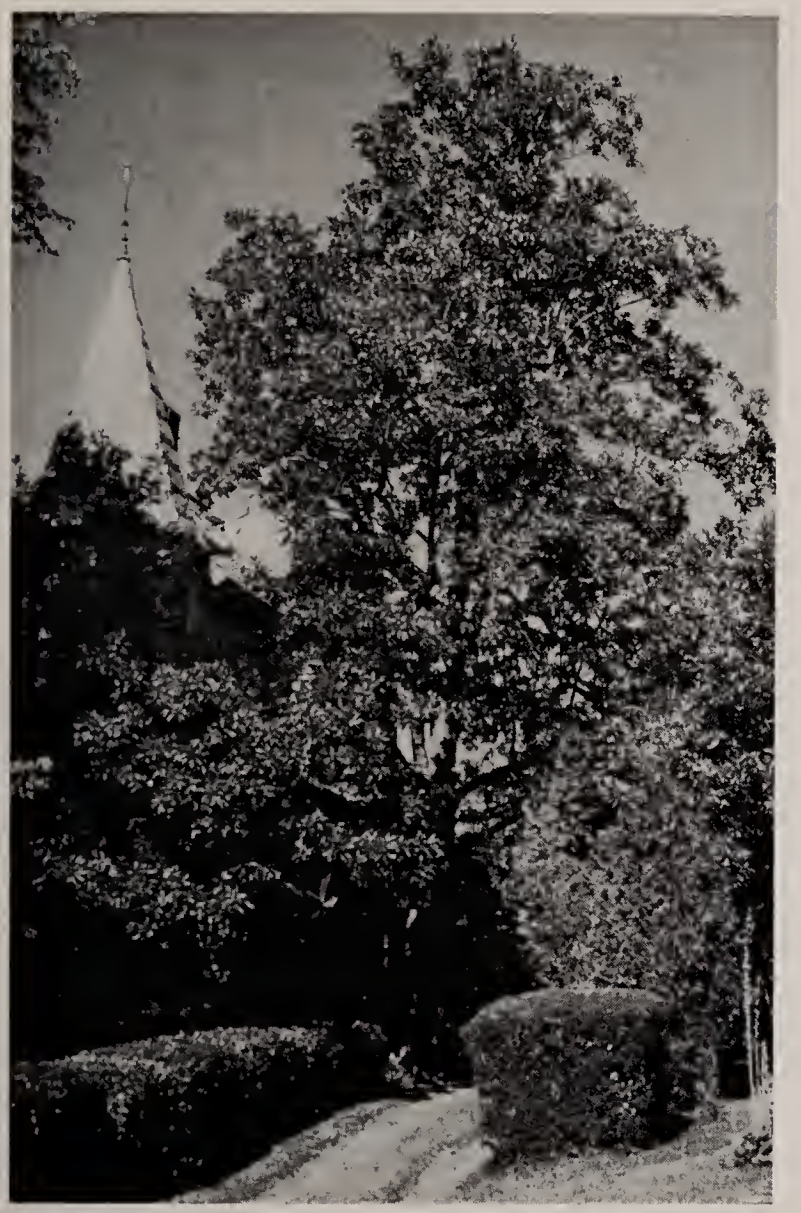

Fig. 18. This old tree of *M. virginiana* var. *australis* cultivated in The Tennessee Valley at Bridgeport, Alabama, has wider than usual crown.

Plants of var. *australis* from its two Tennessee outposts and other sources are being evaluated now at Urbana, where it has been used for intravarietal, intervarietal and interspecific crosses. The *australis* clone that has probably been best tested for leaf persistence and good performance under northern conditions, however, stems from a tree that the late Henry Hicks, Long Island nurseryman, gave to the Arthur H. Scott Horticultural Foundation at Swarthmore College. We do not know his original source, but grafts of this clone show typical *australis* characteristics at Urbana. It has remained evergreen even with Mr. Leach at Brookville, Pa., in winters with −17° F. temperatures, so apparently it should become a widely-adapted evergreen cultivar. (Fig. 17). It apparently is slower growing than many *australis* seedlings.

Most of the "intermediate" clones I have examined show a habit generally similar to typical *M. virginiana,* without such wide variations in flowers, foliage and fruits as noted above for some clones. One "intermediate" tree in Springfield, Illinois, bears seeds with the palest colored coat I have seen in the species.

A more detailed taxonomic paper on varieties in *Magnolia virginiana* awaits further studies of living and herbarium material. Meanwhile, I should be glad to hear from anyone who has found an "intermediate" tree of it in the wild, or who has observed any other variant form of horticultural interest.

Several young seedlings I have grown from seeds of two Illinois-planted var. *australis* trees need further observation as they develop. From open-pollinated seed (possibly pollinated by typical var. *virginiana,* or else from selfing within the clone) some so far anomalous-appearing seedlings do not fit into either typical *virginiana, australis* or the "intermediate" as discussed above. One, though holding most of its leaves green until their *second* autumn in a house-shaded site at Urbana, has as little pubescence as typical *virginiana.* From pollination of *australis* with pollen of *M. grandiflora* 'Samuel Sommer', I obtained two true hybrids and some apparent apomicts, (common in several *M. virginiana* progenies), plus a seedling generally resembling *australis,* except that its leaves are not really glaucous. It is densely pubsecent on leaf undersides and first-year stems. Perhaps it is a mutant. (Fig. 19).

Hybrids of sweet bay are worthy of another article. Known primary hybrids between one or more *M. virginiana* variety and other American or Asian species of the subgenus *Magnolia* include the following:

M. virginiana × *M. tripetala* (= *M.* × *Thompsoniana*)

Fig. 19. At left, a normal *M. virginiana* var. *australis* seedling; at right, a very pubescent but non-glaucous seedling from the same seed parent at Urbana, Illinois.

M. virginiana (including var. *australis*) × *M. grandiflora*

M. virginiana × *M. macrophylla*

M. virginiana × *M. obovata*

Back-crosses to both parents have been made with pollen of the 'Freeman' hybrid (*M. virginiana* × *M. grandiflora*) and one semi-evergreen clone was produced by William F. Kosar at the U. S. National Arboretum, from 'Freeman' × *M. Fraseri*. The other two diploid North American Magnolias not included in the crosses just listed, *M. pyramidata* and *M. Ashei,* have ranges on the Gulf Coastal Plain where *M. virginiana* var. *australis* is abundant. Their flowering seasons begin earlier, but may occasionally overlap with that of the southern sweet bay, so that crossing with them could occur. I have seen one sterile specimen collected by Tom Dodd, Jr., near De Funiak Springs, Florida (October, 1965) which I think combines *australis* and *pyramidata*.

Crossing between the diploid *M. virginiana* and the hexaploid *M. grandiflora* in their large coincident range may have been rather frequent. The not entirely sterile behavior of the 'Freeman' and similar hybrids indicates that *virginiana* var. *australis* × *grandiflora* crosses of natural occurrence may well have introduced some of the extreme variability we now see in *M. grandiflora*. While *M. grandiflora* will contribute a preponderance of chromosomes, and tend therefore to be highly dominant in the F_1 of any cross with a diploid, and in later segregating generations, introgressions could occur from back-crosses to either parent species. The indications are that a number of the more extreme forms in *M. grandiflora,* including perhaps several of those introduced as cultivars over the past 150 years, are derived from at least remote hybridization with one or another of the sweet bays. Similarly, forms of *M. virginiana* var. *australis* with longer than average leaf-retention may owe this character of introgression by *M. grandiflora*. Studies with my developing back-cross seedlings of *M. virginiana* × 'Freeman' (and similar-appearing seedlings of *virginiana* × 'Charles Dickens') should give more information on this possibility.

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The Fourth Barnes Lecture

The fourth in the series of Laura L. Barnes Lectures in Botany and Horticulture will be held on Wednesday, April 13, 1966. The speaker will be Dr. Walter H. Hodge, of the National Science Foundation, who will present an illustrated lecture on the "Terrace Gardens of Peru."

Dr. Hodge spent several years in Peru as Botanist with the U. S. Cinchona Mission, searching for new sources of cinchona bark for the production of quinine. He has returned to Peru several times, most recently in 1965, and few persons possess his intimate knowledge of the rich flora of this mountainous country. He has also traveled widely in many other tropical and sub-tropical countries.

Philadelphians will remember Dr. Hodge as Director of Education at Longwood Gardens, a post which he occupied from 1955 until 1960, at which time he resigned in order to become Program Director for Systematic Biology of the National Science Foundation.

As in previous years, this lecture will take place in the Auditorium of the Springside Upper School at Cherokee Street and Willow Grove Avenue. The time: 8:30 P.M. Associates and their friends are most cordially invited to attend.

Biochemical Studies in Magnolia III. Fruit Anthocyanins

Frank S. Santamour, Jr.

Many species of *Magnolia* produce fruits that show evidence of anthocyanin pigmentation. The proportion of the fruit that is pigmented may vary from almost total pigmentation (*M. tripetala* L.) to a faint tinge of color produced on portions of fruits exposed to direct sunlight (*M. denudata* Desrouss). In view of the earlier work on floral anthocyanins[1], it is of interest to compare the anthocyanin types in flower and fruit and to determine the anthocyanins in fruits of species that lack significant floral pigmentation.

The methods and procedures used in this study have been described in the earlier paper. Briefly, paper chromatography of the anthocyanins in two solvent systems and of the aglycones in a single solvent was utilized. Control substances were derived from the work with floral anthocyanins.

In all species and cultivars investigated in this study, the only glycosidic type was the 3-rhamnoglucosido-5-glucoside and the aglycones were as before, cyanidin and peonidin. No 3, 5-diglucosides or 3-glucosides were found in the fruits.

Of the species which also contained floral anthocyanins, *M. Sieboldii* K. Koch fruits produced the same anthocyanins as in the filaments; peonidin 3-rhamnoglucosido-5-glucoside. *M. tripetala L.* also contained the same anthocyanins as in the filaments, but in the fruit the peonidin glycoside rather than cyanidin, was predominant. The peonidin 3,5-diglucoside found in the filaments of *M. obovata* Thunb. was not present in the fruits. *M.* × *Soulangiana* 'Alexandrina', which contained only peonidin glycosides in the floral parts was found to produce both peonidin and cyanidin pigments in the fruits. On the other hand, a seedling of *M. grandiflora* 'Charles Dickens' gave fruits which lacked the cyanidin found (with peonidin) in the filaments.

Several species were studied that did not possess conspicuous floral pigmentation, and their fruit anthocyanins did not differ from the general pattern that had been determined. *M. acuminata* L. contained both cyanidin and peonidin glycosides, with the cyanidin predominant. The closely-related *M. cordata* Michx. gave only the cyanidin glycoside. *M. denudata* Desrouss. and *M. salicifolia* (Sieb. & Zucc.) Maxim. produced only the peonidin glycoside while equal amounts of both glycosides were found in *M. Kobus* DC. and *M. virginiana* L.

The genes controlling hydroxylation and methylation of anthocyanins may frequently exert different responses in different tissues. It is obvious that no clear pattern of change is evident from the present study. The major point is the uniformity of anthocyanin types encountered in both flowers and fruits.

[1] Santamour, Frank S., Jr. Biochemical studies in Magnolia I. Floral anthocyanins. Morris Arb. Bull. 16: 43-48, 1965.

Cytological Notes II. Phellodendron

Frank S. Santamour, Jr.

The genus *Phellodendron* (Rutaceae) contains about eight or nine species, all native to eastern Asia. The generic appellation translates into "cork-tree", and indeed the bark of mature specimens of some species has a distinctly corky appearance. While widely planted in the Soviet Union for shelterbelts, members of this genus are represented mainly in ornamental plantings in the United States.

To our knowledge, no chromosome counts have been previously reported in this genus, Cytological studies were carried out on male trees (*Phellodendron* is dioecious) of two species in 1965, using standard aceto-carmine squash techniques. Meiotic counts of *P. Lavallei* Dode (M-1712) and *P. amurense* Rupr. (M-54-1436), a plant originally obtained from the Arnold Arboretum, gave n=38 chromosomes. This count was confirmed by a mitotic count of 2n=76 in leaf tissue of *P. amurense*. Two of the chromosomes of the diploid complement bore distinct satellites.

These plants should probably be considered as tetraploids based on an assumed basic number of x=19. Of the numerous species of Rutaceae that have been reported thus far, only the genus *Crowea* has this basic number.

A New Butterfly for the Arboretum

Arthur M. Shapiro

On September 22, 1965 a University of Pennsylvania student on a biology field trip secured the first example of the Little Sulphur, *Eurema lisa* Bdv. (Pieridae), recorded from the Morris Arboretum. The capture raises the number of species taken in the Arboretum and immediate vicinity to 70.

The insect was captured somewhere within what was designated as Area 1 (b) of the Arboretum in the author's 1963 paper[1], i.e. in the meadow south of the intersection of Stenton and Northwestern Avenues.

Although the specimen is a fresh male, it appears doubtful that the species breeds at the Arboretum, at least at this time. Its food plant, Wild Sensitive Plant (*Cassia*), is very local in its occurrence, mainly on sandy soils, and has not been found in the Arboretum. The nearest breeding colony of the Little Sulphur is located atop a hill southwest of the Bells Mill Road bridge over the Wissahickon Creek, about a half mile away. The intervening country is mostly wooded, and *E. lisa* generally shows reluctance to fly into shade. It is likely that the Arboretum individual rose above the tree tops and was carried to the site of its capture by the wind. Other nearby colonies are near the Cresheim Creek and in Mount Airy. The species is more common below the Fall Line.

The continuing drought and mowing in Areas 1 (b) and 1 (a) have apparently combined to produce marked adverse effects on the Arboretum butterfly fauna. The Silver Crescent, *Chlosyne* nycteis, and the Eyed Brown, *Lethe eurydice,* were both completely absent from the Arboretum this year, and only two Two-Spotted Skippers, *Euphyes bimacula,* were seen in the marsh (Area 1-c). Other species were also reduced, particularly the Meadow Fritillary, *Boloria toddii,* of which only twelve were seen in the entire 1965 season. The Buckeye, *Precis coenia,* was absent again but it was numerous in the Tinicum marshes and may spread northward again in 1966 if the winter is not too severe. The Painted Lady, *Vanessa cardui,* was not seen until early November, when several were taken in Areas 1 (a) and 1 (b). The species appeared simultaneously at Tinicum and on the New Jersey shore.

No further specimens of the Bronze Copper and Hobomok Skipper have been taken at the Arboretum, leaving their resident status in doubt. It appears likely that any future additions to the Arboretum list will be based on windblown strays, as in the case of *E. lisa*.

[1] Morris Arboretum Bulletin. Vol. 14. p. 9. 1963.

Arboretum Activities

(*Continued from Page 2*)

ducting a course on General Mycology. Both of these courses are presented on the campus of the University, but include field studies which utilize the resources of the Arboretum.

Dr. Santamour has received a research grant from the American Philosophical Society for a study entitled "Crossability Patterns in *Magnolia* and their Chemical Basis." This study is part of the comprehensive biochemical evaluation of this genus that was initiated in 1965, and is designed to correlate genetical and biochemical data. The funds provided by the grant include support for a Research Assistant on the project.

Winter time is repair time

With the coming of winter and the cessation or at least diminution of out-door activities, attention is directed to a number of other chores. Machinery is overhauled, picnic tables are sanded and varnished, laboratory chairs used in the summer course are repaired, pots are washed, new labels are made and old ones are adjusted or replaced.

This last operation, which is under the direction of Messrs. Henry J. Burns and James Galetti, is an extremely important one. One of the most bitter criticisms which can be directed

against an arboretum by its visitors is that its plants are not adequately labeled. Therefore an attempt is made during the winter months to visit every tree or shrub on the grounds and check on the condition of its label. The labels of many of our large trees are fastened to an expansible stainless steel band invented by Dr. J. R. Schramm, former Director of the Arboretum. These bands require periodic examination to determine whether they have become loose or have reached the limit of their expansion. In the first instance they must be tightened; in the second they are replaced with a larger size to accommodate the growth of the trunk.

The stainless steel labels which are attached to most of the shrubs or small trees also need attention. Some of these become bent, others are obscured by the growing plant and have to be re-located, still others just "disappear" and must be replaced. We are grateful for the dormant season which furnishes leisure to make new labels and renovate old ones.

Quince jelly, anyone?

One of the rarest and most interesting plants in the Arboretum is a specimen of Chinese quince (*Chaenomeles sinensis*). Unlike its cousin, the Japanese or flowering quince (*C. lagenaria*) which is a shrub, this species is a small tree with handsome flaky bark. Its flowers are light pink and the leaves turn a burning scarlet here in autumn.

Our large specimen, which is about 35 years old, is unfortunately located in an area which was formerly included in a large nursery on the "farm" and is therefore seldom seen by visitors. We have, however, made cuttings of it and one of these is in the newly established bark collection which was described in an earlier issue.

The parent tree started to bear fruit several years ago, but the crop was always rather meager and the quinces, which are frequently 15 cm. (about 6 inches) in diameter, might have been counted on the fingers of two hands. In the autumn of 1965, however, this tree was so heavily laden with fruit that we started giving it away to anyone who expressed an interest in it.

One of our Associates, Mrs. Edmond G. Thomas, converted her allotment into a jelly of such excellent quality that we wished we could share it with all of our nearly 900 Associates. This was obviously impossible but Mrs. Thomas kindly made enough so that we could deliver samples at Christmas time to those members of the Advisory Committee who live within easy reach of the Arboretum. The response was enthusiastic and we were assured that we were growing a remarkably fine quince. We hope that those of you who are interested in experimenting with this fruit next year will let us know so that we may distribute them as long as they last.

Spring Garden Tour

Due to complications inherent in the University calendar, there can be no Morris Arboretum European Tour in the Spring of 1966. Instead, plans are being formulated for a six-day visit by plane and bus to some of the renowned arboretums and botanical gardens of New York and New England.

The tentative schedule calls for a departure by plane from Philadelphia to Rochester early on the afternoon of Monday, May 23. That afternoon and the following morning will be devoted to visiting the two fine Arboretums which are part of the Rochester Park System.

The party will leave Rochester after lunch on Tuesday and proceed by chartered bus across New York to Esperance to visit the George Landis Arboretum. This is a relatively new, but extremely interesting, collection.

After spending Wednesday morning at the Landis Arboretum, we shall drive eastward into Massachusetts and spend the night near Lennox in the Berkshires. On the following day (Thursday) the party will continue on to Boston, spending that afternoon and the next day visiting the Arnold Arboretum and the Case Estates at Weston and on Saturday, May 28 we shall return by plane to Philadelphia.

As in the past, this tour will be conducted by the Director of the Arboretum and his wife. Since the size of the party will have to be limited, it is suggested that anyone who is interested either write to the Morris Arboretum, 9414 Meadowbrook Avenue, Philadelphia, 18, or call CH 7-5232.

J. M. F., Jr.

Associates' Corner

Of the Keeping of Records there is no End.[1]

The need for the maintenance of an accurate system of plant records in an arboretum or botanical garden can not be overemphasized. One of the features which distinguishes such an institution from a public park or a private garden is, or should be, its ability to identify the origin or provenance of every plant in its collection and also to store information concerning its progress from the day of its accession until the date of its demise. Ideally such a "case history" should reveal whether the specimen was received as a seed, a rooted cutting or a growing plant, as well as when it was removed from the greenhouse, to the coldframe, to the nursery, to its permanent place on the grounds, when it was sprayed (and for what), when it was fertilized (and with what), when cuttings were made from it and, since plants are not immortal, when and why it died.

Fortunate, indeed, is the institution which, starting from scratch, can incorporate all of these details into its records. Our own case is sadly different. Between 1890 and 1932 (when it was bequeathed to the University of Pennsylvania) this property was the estate of the Morris family. The records dating from these early years are usually scanty and often entirely wanting. Frequently we have to depend upon the memory of our retired Superintendent, John Tonkin, to learn whether such and such a tree or shrub was obtained from the Arnold Arboretum, from some nearby nursery, or from some other source.

Today our system is a relatively simple though fairly reliable one. As soon as a plant is acquired (whether by purchase, exchange or as a gift) it is given a number, the first two digits of which are the last two digits of the current year. For example, in December, 1965, we received two plants of *Gaylussacia brachycera*. These were at once labeled 65-367 A and 65-367 B, indicating that they were the 367th accession received during 1965 and that there were two of them of the same origin.

This number is immediately entered in India ink in a large record book, together with all information pertinent to the origin of the plant and the number stays with the plant as long as it lives. If cuttings are rooted from it they will be given a new number according to their chronological sequence, but the original number will be carried along also as part of the complete record.

Before the plant leaves the record room there is attached to it a small metal label bearing its number. This label, which is punched out on either a Dymo-mite tapewriter or a Roovers Midgie hand-labeling device, remains on the plant during its sojourn in greenhouse, lathhouse, cold frame or nursery. Only when it is set out in the Arboretum is it accorded a display label giving its common and scientific names, plant family and native country.

From the entry in the afore-mentioned record book there is prepared a 3 x 5 inch card on which the plant is identified by genus and species, plus such sub-specific epithets as variety, form, cultivar, etc. These cards are later filed alphabetically, which gives us a ready means of reference to the plants in our collection on a purely alphabetical basis. From them we can quickly tell just which species and varieties we have of any given genus.

Since our herbarium contains specimens of most of our plants collected in flower, in fruit and in dormant condition, these sheets also constitute an integral part of our over-all record system, especially since each herbarium label contains the Arboretum accession number as well as a key number indicating its position in the Arboretum.

This brings up a final, but very important, point. The Morris Arboretum is laid out in a series of numbered grids, 200 feet on a side. Each grid or quadrangle has a designation, such as B 8 or K 17 and the card in the Records Office as well as the specimen in the Herbarium should indicate in which grid a given plant may be found.

It is obvious that the effectiveness of such a system depends upon constant and complete cooperation between the grounds personnel and the Records Office.

[1] This account is based upon an article which Dr. Fogg wrote for the quarterly Newsletter of the American Association of Botanical Gardens and Arboretums. Feeling that the contents would be of interest to our Associates, I have obtained permission to reproduce it here.

Marion W. Rivinus

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Arboretum Activities

THE STAFF

On April 1 the Director gave an illustrated lecture on "European Botanical Gardens" at the Royal Botanical Garden in Hamilton, Ontario. At the invitation of the President of the Philadelphia County Medical Society, Dr. Fogg attended a meeting of their Deans' Committee on April 14 for the purpose of giving a talk on the Arboretum's Medicinal Garden.

On April 26 the Director gave an illustrated lecture entitled, "Barrens, Bogs and Beaches of South Jersey", before the members of the Faculty Club of the University of Pennsylvania and on May 19 he was the principal speaker at the Annual Banquet of the American Herb Society; his topic was, "The Search for New Drug Plants."

At the Spring meeting of the Friends of the Wissahickon, which was held on May 20, Dr. Fogg gave an illustrated talk on, "The Plants of the Wissahickon Valley." Between May 23 and 28 he and his wife conducted a Garden Tour of some of the important botanical gardens and arboreta of New York and Massachusetts. An

(Continued on Page 27)

The Morris Arboretum 1966 Garden Tour

John M. Fogg, Jr.

From May 23 to 28 the Director and his wife conducted a group of thirty persons on a tour of some of the more important arboreta, botanical gardens and institutions of botanical and historical interest in New York and Massachusetts. With the thought that others may some day be interested in following our footsteps, the following brief account of our travels is presented.

Our party left Philadelphia by plane on Monday, May 23, for Rochester, New York. Here we were met by Mr. Bernard Harkness, Plant Taxonomist for the Monroe County Department of Parks, who guided our chartered bus to Highland Park, an area of about 100 acres which forms an integral part of Rochester's beautifully developed Park System.

Our first stop was at the Castle or Administration Building, which is the site of a garden containing many unusual plants. In front of the building is a specimen of the rare cut-leaved black walnut, *Juglans nigra* var. *laciniata*. In an alcove at the rear were such interesting species as *Parrotiopsis Jacquemontiana* (in full bloom), *Akebia trifoliata, Hydrangea Sargentiana, Abelia Graebneriana, Decaisnea Fargesii* and *Lonicera tenuipes*.

In the beds and along the walls of a sunken garden behind the building were many woody and herbaceous plants seldom seen in eastern collections. One of the most intriguing of these was *Podophyllum Emodi*, the Asiatic relative of our familiar May-apple, *P. peltatum*.

Following refreshments, which were served by our host and his wife, we re-entered our bus and drove to the Highland Avenue section of the Park to see the internationally renowned collection of Lilacs. Over 1400 plants, representing some 500 species and varieties, are concentrated in this area, making it one of the finest exhibits of its kind in the world. Unfortunately, due to the lateness of the season, only a few of the plants were in flower; nevertheless these were sufficient to afford a preview of the magnificence of the display. Also, there was much of interest here in addition to the lilacs. As we climbed the slope toward the reservoir we were impressed by such plants as the American Indian pawpaw (*Asimina triloba*) and the Asiatic date-plum (*Diospyros Lotus*), neither of which is overly hardy in the Philadelphia area. Here, too, was a fine mature specimen of the Turkish hazel (*Corylus Colurna*) and not far away one of the largest trees of the Japanese *Magnolia Kobus* var. *borealis* that any of us had ever seen in this country.

Rochester has a superb collection of Magnolias, but we were too late to see most of the Asiatic species in flower. A few, however, were still in bloom and it was a pleasure to see again *M.* × *Soulangiana* 'Niemetz'.

Our afternoon was climaxed by a visit to the Lamberton Conservatory, a series of well planted and beautifully maintained glass houses of which any community could be justly proud. Here were tropical and subtropical plants in luxuriant abundance (ferns, orchids, aroids, etc.), species of economic importance, a brilliant display of seasonal ornamentals and a desert house with a fine collection of cacti and succulents.

Early the following morning the group paid a brief visit to the Rochester Museum of Arts and Sciences, where we were graciously received by Mr. W. Stephen Thomas, the Director. One of the most interesting features of this museum is a series of dioramas showing the underwater life which flourished in quiet inland seas in this area during Silurian and Devonian times, approximately 300 million years ago. Here are trilobites, brilliantly colored corals and sponges, sea anemones and sea lilies (crinoids), straight and coiled cephalopods, nautiloids and primitive fish. One case contains a reconstruction of a gigantic sea scorpion or eurypterid, the most rapacious predator of these waters during the Silurian period. Nearby are cases containing some of the actual fossils from which these exhibits were prepared.

Of great interest, also, are dioramas depicting the exisiting plant and animal life of the Rochester area. One large case displays the native plants, with many of the local birds, as they would be observed in spring, summer and autumn. Others show the mammals of the area, including a realistic depiction of the construction of a beaver dam.

Fig. 20. Conifers in the Durand-Eastman Arboretum at Rochester

The upper floors are devoted to a survey of the historical and cultural development of the area. Although small by comparison with some of our municipal institutions, this museum boasts a magnificent concentration of beautifully conceived and finely executed exhibits.

At 9:30, Mr. Harkness, our host of the previous day, joined us and led our party to the largest of Rochester's arboreta, the Durand-Eastman Park, an area of about 500 acres of deeply eroded glacial silty-loams along the south shore of Lake Ontario. An outstanding feature of this arboretum is the superb collection of mature conifers, many of them dating back to the last century. (Fig. 20). Here are majestic specimens of more than 20 species of *Abies,* about an equal number of *Picea* and an even greater variety of pines, including two specimens of the rare Mexican *Pinus ayacahuite.* The area is also rich in cherries, maples, magnolias and many other groups of deciduous trees. (Fig. 21) Of interest to many of our group was to see *Daphne Mezereum,* which is generally regarded as somewhat tender in the Philadelphia area, growing almost like a weed.

Although this arboretum merits much more time than we were able to devote to it, we had a busy schedule ahead of us and it was necessary immediately after lunch to enter the New York Thruway and drive eastward to Johnstown, where we had reservations for the night.

On the morning of Wednesday, May 25, we made a brief stop at the baronical manor of Sir William Johnson, located on the outskirts of Johnstown, and then drove south to Esperance, N. Y., to visit the George Landis Arboretum, which is an affiliate of Union College. This arboretum, which was established in 1951 as a memorial to Dr. George Landis of Rensselaer Polytechnic Institute, is under the direction of Mr. Fred Lape, whose book entitled "A Garden of Trees and Shrubs" was recently reviewed in these pages.[1] Located on the western slope of the Schoharie Valley, at an elevation of 1000 feet, this arboretum of approximately 50 acres offers a rigorous testing ground for the growing of ornamental trees and shrubs, as well as a wide selection of annuals and perennials. Mr. Lape has assembled a fine collection of tulips, iris, and flowering bulbs suitable for the rock garden. One of the most surprising in the last named group were several robust plants of *Allium karataviense,* a native of Turkestan.

Mr. Lape's record of failures and successes with a wide variety of conifers, rhododendrons and broad-leaved evergreens should provide a valuable education and a fair degree of encouragement for all who attempt to grow such plants in a wind-swept area where winter temperatures frequently drop to 20° below zero.

The collection at present includes some 250 genera and about 1000 species and varieties of trees and shrubs. Among the truly unusual items were a flourishing specimen of the bristle-cone-pine (*P. aristata*) (Fig. 22) and a small but still struggling plant of *Nothofagus.* (Mr. Lape explained that he simply *had* to have at least one species from the Southern Hemisphere!) The larger groups include an amazing number of different kinds of cherries, crabapples, oaks, maples, lilacs, barberries, cotoneasters, viburnums, and honeysuckles — altogether an impressive assemblage in a region which presents such severe growing conditions. It was of considerable interest to hear Mr. Lape say that one of the hardiest rhododendrons in his collection was *R. laetevirens.*

Leaving the Landis Arboretum, where most welcome refreshments were provided by our host, and stopping for lunch at Duanesberg, our bus proceeded eastward along the Thruway into

[1] Morris Arb. Bull. Vol. 16. 62. 1965.

Fig. 21. Members of the Tour in the Durand-Eastman Arboretum

Fig. 22. *Pinus aristata* at the George Landis Arboretum

western Massachusetts, where accommodations had been reserved at Lenox in the Berkshires. Before checking into our lodgings, however, we made a brief detour to inspect the beautiful lawns, formal boxwood plantings, fine old elms, and the impressive white pines and canoe birches at the Tanglewood Music Center.

Our first visit the following morning was to the Berkshire Garden Center at Stockbridge, where we were received and delightfully entertained by Mr. C. Roy Boutard, the Horticultural Director. This Center which was founded in 1934 for the dissemination of horticultural information, is supported by several organizations. Among its many attractive features are perennial borders (which were very colorful at the time of our visit), rock plantings, a wild-flower garden, rose borders, a bog for aquatic species, a primrose walk, trial gardens for iris, daylilies, etc., and a terraced herb garden.

The entire garden has been very skillfully designed in an informal manner, with effective use of coniferous and flowering shrubs and the utilization of native limestone outcrops. One of the features that most intrigued our members was the planting of the evergreen European wild ginger (*Asarum europaeum*) as a ground cover in a shaded area.

Returning through the town of Stockbridge we paused briefly to inspect Mission House and its delightful garden. This was the home of John Sargent who came from Boston as a missionary to the Indians in the late 1600's. Nearby is the brick church erected for the distinguished preacher, Jonathan Edwards.

Our way then led eastward across the Massachusetts Turnpike to Northampton, where we had luncheon at Wiggins Tavern. Here we were joined by Mr. William I. P. Campbell, Horticulturist at the Botanic Garden of Smith College, which we had come here to see.

This must certainly rank as one of the finest college botanic gardens in this country. Its greenhouses are replete with a wealth of interesting and unusual plant material and its perennial borders were a riot of color. For most of us, however, the greatest treat was the beautifully designed and very extensive rock garden. (Fig. 23). In addition to the standard species usually found in such plantings, this garden contains a wide range of material in such genera as *Androsace, Saxifraga, Potentilla, Geranium, Gentiana, Phlox,* and many others.

The planning and the maintenance of the campus are also under Mr. Campbell's jurisdiction and as we wandered through a small section of its extensive and diversified plantings of trees and shrubs we attained a fuller insight into the measure of his skill as a horticulturist.

Our last visit that day was to the famous Hunnewell Pinetum on the shores of Lake Waban in Wellesley. Many of the conifers in this collection were planted more than a century ago and it is therefore possible to see here remarkably fine specimens of pines, spruces, firs, cedars, hemlocks and many other group from Europe and Asia as well as from various sections of our own country. For those who admire topiary art there is an interesting display in a section along the shores of the lake (Fig. 24). We are greatly indebted to Mrs. Walter Hunnewell for having permitted us to visit this superb Pinetum.

It had been a full day and the members of our group were entirely willing to check in at our hotel in Boston late in the afternoon.

Friday, May 27, was devoted to what has appropriately been called America's Greatest Garden, namely, the Arnold Arboretum of Harvard University at Jamaica Plain. Here we were welcomed by Dr. Richard A. Howard, Director of the Arboretum and Arnold Professor of Dendrology. Dr. Howard guided our bus on a compre-

Fig. 23. Section of the Rock Garden at the Smith College Botanic Garden

Fig. 24. Topiary Garden in the Hunnewell Pinetum

hensive tour of the grounds, pointing out the more important groups of plants such as maples, cork trees, dogwoods, horse-chestnuts, forsythias, lilacs, conifers, rhododendrons, crab-apples, cherries, hawthornes, etc. We ascended to the top of both Bussey Hill and Peters Hill, disembarking briefly at the latter to enjoy the magnificent view across the arboretum, with the skyline of Boston in the background.

The bus then took us back to the area devoted to shrubs and vines, where we spent about an hour enjoying the richness of this fine collection which contains over 800 species and varieties. One of the genera best represented here is *Chaenomeles* and these were at the height of their bloom. *Potentilla fruticosa,* in a wide variety of color forms, was making a fine show and our native *Neviusia alabamensis* was a thing of lacy beauty. (Fig. 25).

We were due at the Dana Greenhouses by noon and our walk took us through the lilac planting. (Fig. 26). Although we had missed the height of the lilac season at Rochester, the splendid condition of the plants here at the Arnold largely compensated for that loss. The Arnold collection of *Syringa,* while not as large as that at Rochester, has been very discriminatingly assembled and includes a truly representative series of species and cultivars. One of the most interesting is a new yellow-flowered clone known as 'Primrose.'

Arriving at the greenhouses, we found that Dr. Howard and his staff had arranged an elaborate sherry party. The layout contained a variety of hor d'oeurves, such as cashews, macadamias, squash seeds, pinyons and sliced coconut. Beside each offering was a herbarium sheet of the plant from which it is obtained and the members of the party were invited to identify these specimens before partaking of liquid nourishment.

Before lunch at a nearby restaurant we paid a brief visit to the Forest Hills Cemetery which is truly a botanical garden in its own right. Few places of its kind can display such a intelligently arranged and diversified array of both woody and herbaceous plant material.

Following lunch we returned to the greenhouse area where Mr. Alfred J. Fordham, the Arboretum's Propagator, graciously conducted members of the group through the greenhouses and demonstrated some of the interesting propagating experiments which he has in progress, especially those concerned with germination.

In close proximity to the greenhouses is the octagonal structure which houses the arboretum's famous Anderson Bonsai collection, some of the specimens of which are 200 years old or more. At the foot of the slope below this building is the newly established hedge demonstration plot and to the north of the headhouse is a distinguished collection of dwarf and low-growing conifers, many of which will soon be moved to a new site which is being prepared for them.

During the balance of the afternoon some of the members of our group wandered off to take pictures in sections of the Arboretum which we had seen from the bus during our morning tour, others went to inspect the library and the herbarium, and still others remained behind to engage in further conversation with Mr. Fordham concerning the basic problems of the propagation of woody plants. For the seriously botanically-and horticuturally-minded members our tour this day spent at the Arnold Arboretum will ever remain as a memorable experience.

On the following day (May 28) we headed our bus in the direction of Weston for the purpose of visiting the Case Estates of the Arnold Arboretum. Despite a light drizzle, we were enthusiastically greeted by Dr. Donald Wyman (the distinguished Horticulturist of the Arboretum) and his wife who conducted us on a walking tour through this vitally important adjunct of

Fig. 25. *Neviusia alabamensis* at the Arnold Arboretum

Fig. 26. A portion of the lilac collection at the Arnold Arboretum

the Arboretum. Here are the nurseries in which many of the plants destined for the Arboretum in Jamaica Plain are grown and evaluated. Here is the quarantine area where those plants imported from abroad are held under special post-entry restrictions before being released to other institutions. Here are standardized trial and display plots for lilies, hemerocallis and daffodils. Here is the well-known ground cover trial garden containing more than 150 different kinds of plants which can be used as ground covers. (Fig. 27). Here is a fascinating low maintenance perennial garden and here are many other special collections of significant interest to the botanist and horticulturist.

Following luncheon at the charming Sudbury Inn we moved to the last scheduled stop on our itinerary, namely, the Will C. Curtis Garden in the Woods at Framingham. Here in a wooded area of many acres, with seemingly endless miles of winding trails, is a wild flower garden of great distinction which now belongs to the New England Wild Flower Preservation Society. We were graciously received by Mr. Will C. Curtis, the Director, and Mr. Howard O. Stiles, the Curator, and permitted to wander at leisure throughout the preserve.

It would require many pages to enumerate the detailed aspects of this garden. Suffice it to say that here, in an ideal setting, are to be found growing pratically all of the native wild flowers of eastern North America, plus many of those from other continents, such as Europe and Asia. Here were four species of lady-slipper orchids (*Cypripedium*), two of *Clintonia* (*C. borealis* and *C. umbellulata*), many kinds of wake-robin (*Trillium*), and wild-ginger (*Asarum*), the rare Fraser's sedge (*Cymophyllus Fraseri*), and great sheets of foam-flower (*Tiarella cordifolia*), as well as the famous *Shortia galacifolia* from our southern mountains. The area includes a lily-pond, a sunny bog and a small but highly selective rock garden. Many species of ferns are also in abundance. Certainly every traveler with an interest in native plants should include this garden in his itinerary.

Late that Saturday afternoon our tour underwent what, in lower organisms, would be called binary fission. About half of our party returned to Philadelphia from the Boston airport. The other half accompanied the director and his wife on what might be termed an Extension Tour to Harwich Port on Cape Cod, where for the next two or three days we saw something of the botanical and horticultural resources of that portion of the state.

On Sunday morning, May 29, the group drove by private cars to visit the wind forests on the outer "fore-arm" of the Cape between Wellfleet and Truro. Here, in an area of several square miles, the pitch pine (*Pinus rigida*) and scrub oak (*Quercus ilicifolia*) are seldom more than three or four feet tall. Here great sheets of bearberry (*Arctostaphylos uva-ursi*) form an impressive ground cover (they were in full flower on the occasion of our visit) and here Conrad's crowberry (*Corema Conradii*) predominates as an evergreen sub-shrub, looking for all the world like a miniature hemlock (Fig. 28). To Philadelphia botanists, the region bears a strong resemblance to the Pitch Pine Plains of southern New Jersey.

That afternoon we had the privilege of visiting the private garden of Mr. and Mrs. Harold Copeland at Chatham. Mr. Copeland has for several years been a very discriminating collector of heaths and heathers, as well as hollies, peonies and many other groups of plants. It was a rare privilege to have him conduct us around his garden and listen to his comments upon the degrees of hardiness, or lack thereof, which his many years of experience had taught him to expect of the plants which he had attempted to grow in this exposed 'elbow' of the Cape.

Fig. 27. Ground cover collection at the Case Estates in Weston, Massachusetts

Fig. 28. Wind Forest between Wellfleet and Truro on Cape Cod

Monday, May 30, was a holiday, but despite this fact Mr. Milford Lawrence, Proprietor of the Cape Cod Nursery at East Falmouth, had said that he would be happy to have us pay him a visit. We arrived, eighteen strong, and were warmly welcomed by him and his wife. Mr. Lawrence is not only a nurseryman but a very accomplished landscape architect. It is my own impression that at least half of the great estates on Cape Cod have been designed and planted by him. Following an hour or so devoted to wandering through this nursery, with its marvelous assortment of trees and shrubs of known hardiness under Cape Cod conditions, we were taken by the Lawrences to see their impressive greenhouses and show-rooms in Falmouth. We then had luncheon in a restaurant overlooking the marina in Falmouth, after which Mrs. Lawrence had arranged, despite the fact that it was Memorial Day, for us to visit the fascinating new Museum and Aquarium of the U. S. Bureau of Fisheries at Woods Hole.

Our final visit of the day, and of our entire Tour, was to the Ashumet Holly Reservation and Wildlife Sancturary of the Massachusetts Audubon Society in Falmouth. This preserve, which is now under the direction of Mr. Lee C. Davis, comprises 45 acres of upland sandy loam which support, among other things, a collection of some 2000 specimens of hollies, many of which were originally selected some 40 years ago for excellence by Mr. Wilfred Wheeler. Following Mr. Wheeler's death, Mr. and Mrs. Josiah K. Lilly purchased this property and donated it to the Massachusetts Audubon Society in order to preserve the type locality of many of Mr. Wheeler's specimens as well as to establish a wild life sanctuary.

In addition to hollies, the area includes a fine collection of dogwoods, rhododendrons, magnolias, and many other native trees and shrubs, including the renowned Franklin tree discovered by Philadelphia's John Bartram in Georgia in 1765. We feel that this visit served as a fitting climax for the Morris Arboretum's 1966 Garden Tour.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since March, 1966:

Mrs. William E. Barrett
Mr. Charles W. Clause
Mr. John L. Evans
Mrs. William Fox
Mrs. Ellen M. Goudlock
Mr. Bruce H. Greenfield
Mr. James B. Harper
Mrs. Richard E. Hess
Mr. Guy Ford Hopkins
Miss Faith Kaltenbach
Mr. George T. Lewis, Jr.
Mr. A. Frederick McGourty, Jr.
Mr. Donald B. Miller
Mr. John Packard
Pennsylvania Landscape & Tree Association
Mrs. A. M. Peterson
Dr. John B. Reddy
Mr. John J. Rodgers
Mr. Harry Santisi
Mr. John B. Ward
Mr. Bernard Wiener
Miss Eleanor Janet Welch
Mrs. Minturn Wright

Alleviation of Drought Damage

Patricia Allison

Well over three years have passed since the Arboretum Bulletin published a paper entitled "Drought Injury."[1] In it plants were described as "botanical weather bureaus" that are capable of continuously recording the adequacy or inadequacy of their water supplies. These records are presented to our eyes as alterations in the behavior of the plants: Growth may be reduced; leaves may be smaller, or drop prematurely; flowering may be suppressed; periodic loss of turgor may culminate in permanent wilting and death. All of these responses indicate that, whatever the amount of water may have been that fell from the sky, it was present in insufficient amounts in the soil where the plants were growing. The last one, death, results when the amount has become so limiting it cannot be "computed" at all.

Of course, there are many more outward symptoms of water shortage that depend upon the characteristics of individual species, as well as upon the time of year that the shortage becomes critical. Beyond this, however, are numerous inward alterations caused even by moderate drought that can lead to consequences fully as grave as permanent injuries resulting from prolonged water shortage alone. These are increases in susceptibility to pathogens and pests.

United States Weather Bureau Record of Precipitation

In the earlier article a table was presented in which the monthly precipitation was indicated as above or below normal for a ten year period. We now are able to add to it.

Table 1. Precipitation at Philadelphia Airport, 1953 to 1966 (+ signifies amounts above average; —, amounts below average for the month. Annual totals in inches.)

Year	Months												
	J	F	M	A	M	J	J	A	S	O	N	D	Total
1953	+	—	+	+	+	+	—	—	—	+	—	+	48.13
1954	—	—	+	+	—	—	—	+	—	—	+	—	34.04
1955	—	—	+	—	—	+	—	+	—	+	—	—	33.03
1956	—	+	+	—	+	+	+	—	+	+	+	+	46.00
1957	—	—	—	+	—	—	—	—	—	—	—	+	32.20
1958	+	+	+	+	+	+	+	+	—	+	—	—	47.87
1959	—	—	+	—	—	+	+	—	—	+	+	+	38.37
1960	—	+	—	—	+	—	+	—	+	—	—	+	41.15
1961	—	—	+	+	0	—	+	—	—	—	—	—	41.05
1962	—	+	+	+	—	+	—	+	—	—	+	—	42.62
1963	—	—	+	—	—	—	—	—	+	—	+	—	34.95
1964	+	+	—	+	—	—	—	—	—	—	—	—	29.88
1965	—	—	—	—	—	—	—	—	—	—	—	—	29.34
1966	—	+	—	+	—								

The comments made in the earlier article were, "From annual totals, it is clear that 1954 and 1955 were dry. The drought of 1957, so damaging to plants, is also revealed in the annual total, the lowest since 1921. The years 1960 and 1961, however, are very close to the 47 year average of 41.20 inches,[2] and 1962 so far (10 months) is only 0.22 inches below normal. Where is the drought? Note the sequence of dry months beginning in August, 1961. There are six. Only 1957 exceeded this during the last ten years with a series of seven dry months. To say that the current series was effectively broken in February, March, and April would be misleading, for the excess averaged less than half an inch a month." If the record at that time evoked concern, the recent additions should be appalling. To be sure, we have seen statements that the city water situation is no longer critical. These, however welcome, have little bearing on "breaking the drought" as far as woody plants are concerned. Unlike rain gauges, trees and shrubs are not vessels that can be emptied out, then refilled with no sign of harm. Dead limbs do not return to life. Enormous populations of pests do not suddenly vanish as soon as reservoirs are filled or rivers run deep. If the weather indeed "broke" we still would be left to cope with a long aftermath already evident among those trees and shrubs that have not succumbed. Understanding the drought symptom lag in woody plants and the complications imposed by pests and pathogens will help us formulate reasonable approaches to the alleviation of drought damage.

The Drought Symptom Lag

A great many woody plants are physically incapable of prompt and obvious symptom development even though important early metabolic changes may occur as the result of insufficient water. About half of their bodies is buried in the soil, and we are prevented from observing root damage or fungus attack until the situation is serious enough to reveal itself by deviations from the normal appearance of above-

[1] Allison, Patricia. Drought Injury. Morris Arb. Bull. 13: 71-74. 1962.

[2] The official norm is now based on the period 1931-1960 and is 42.48 inches.

ground parts. The very architecture of these visible parts delays or prevents early appearance of symptoms. Trees, for example, can be enormous creatures in which local water shortages may be alleviated by contributions from other parts. Further, the core of their substance is massive, stiff, jointless, and dead. Even parts of the living envelope are stiffened, so that collapse of tissue, wilting, can be observed only in soft parts such as young twigs and in leaves. When this begins to happen in very tall trees, it is likely to be hidden at the top. With conifers, even the leaves are of such a shape and consistency that wilting can be detected only in young shoots. So it is with other consequences of drought conditions. Color changes can proceed so gradually that they are not noticed until long after the time of the weather that induced them.

Complications Imposed by Pathogens and Pests

Most of the diseases of woody plants are caused by fungi, and most of them are debilitating. There are notable exceptions, of course, such as Dutch Elm Disease which can be initiated and terminate fatally in a single season. For the most part, drought conditions do not favor the initial attack by fungi, but some of these pathogens require very little time for their first operations, and a few hours of dew can suffice. Once inside, however, many debilitating fungi, such as those rotting roots or causing cankers, are able to assume a more serious role when the host plant is weakened by other causes. This is not necessarily implying that the area in which they are active is enlarged more rapidly, but that the effects of their damages are likely to become more dangerous to the plant.

Fig. 29. Large soft scales on trunk of *Acer Negundo*

Fig. 30. Lady-bird beetle predator near cluster of scales on young twig of *Acer Negundo*

Many insects and mites are much more destructive during dry periods. One has only to consider the plight of many of the hemlocks in the Philadelphia area to appreciate this. Because of the wide publicity given the massive attack of a scale insect on these trees, the long-term destruction by mites during and after the 1957 drought has received little attention. These animals are virtually invisible to the unaided eye, but they have been present in enormous numbers in recent years. Many elms and oaks also have been seriously damaged or killed by scale insects. The bodies of some species of these pests are so well camouflaged that they too often have not been noted, and trees have died that otherwise might have been saved. Not all scale insects are as inconspicuous (Figs. 29 and 30).

Prevention and Alleviation of Drought Damage

1. Learn to recognize potentially serious weather trends so that their effects can be prevented before initial symptom expression. (The Woody Plant Symptom Lag!). Read the daily weather report; learn what "normal" is.
2. Failing this, learn to recognize early minor symptoms of water shortage or pest attack, remembering that what you see is evidence *after* the fact.

3. Act promptly! Learn to water correctly. Control pests while populations are low.
4. Realize that internal drought can be brought about by excessive losses as well as insufficient entry.
   a. Control loss in winter by shielding, or "wilt-proofing" with special sprays.
   b. Promote entry during hot weather by maintaining lower soil temperatures with mulches. This will reduce evaporation as well.
5. Remove dead wood promptly and properly. Maintain a protective coat of paint on exposed heartwood.

Arboretum Activities

(*Continued from Page 18*)

account of this expedition will be found elsewhere in this issue.

Dr. Li has received a grant from the National Science Foundation to enable him to continue his studies on the Flora of Taiwan.

Dr. Allison was a judge of the plant science entries in the Delaware County Science Fair on March 9. On May 12 she was guest lecturer at the Skin and Cancer Hospital of Temple University School of Medicine. Her subject was "Fungi as Pathogens of Plants." She joined the annual Bala-Cynwyd Junior High School Science Weekend at the University of Pennsylvania Camp where she discussed the "Role of Fungi in Biological Research" on May 15. On May 19 she was one of Ralph Collier's guests for "Views and Reviews", broadcast by WFLN. When the Philadelphia Chapter of the American Electrochemical Society met at the Arboretum on May 21, Dr. Allison related some of her experiences as, "A Mycologist in Ecuador."

At a meeting of the Research Club of the University of Pennsylvania, which was held at the Arboretum on April 29, Dr. Santamour discussed several of the research projects he has under way at the Arboretum.

Death of Laura L. Barnes

It is with a profound sense of loss that we record the death, on April 29, of Dr. Laura L. Barnes, Director of the Barnes Arboretum at Merion, Pa. Dr. Barnes was a devoted friend of the Morris Arboretum and had been a member of its Advisory Council since the time of its formation.

In 1940 Dr. Barnes established a School of Botany, Horticulture and Landscape Architecture at the Barnes Arboretum and over a period of more than a quarter of a century nearly 800 students have received instruction in these subjects. Their gratitude was expressed several years by their creation of the Laura L. Barnes Lectureship in honor of this remarkable woman who has made such a significant contribution to Botany and Horticulture in the Philadelphia area.

Spot Broadcasts

By a happy arrangement with Philadelphia Radio Station WFLN, the Arboretum has an opportunity to broadcast a news release every Friday at 1 P.M. and again at 4:15. This announcement may be devoted to calling attention to particular groups of plants which currently are of interest in the Arboretum or it may deal with any pertinent aspect of the Arboretum's activities or matters of botanical or horticultural interest.

Spring Planting

Although the fall of the year is the season most favorable for transplanting, the current spring has provided ideal conditions for this purpose and an amazing amount of material has been moved from the nurseries to permanent positions on the grounds. The list includes about 50 plants of *Viburnum,* over 20 maples, many azaleas and other members of the Ericaceae, the last named of which were placed in our Heath Garden. Of particular interest is a double row of fastigiate cherries which has been established just inside the Meadowbrook Avenue gate. These are known horticulturally as 'Okame', a cross between *Prunus incisa* and *P. campanulata* which was raised by Captain Ingram at Benenden, England.

J. M. F. Jr.

Associates' Corner

The Bee Library

Bees live a fascinating life as well as creating luscious honey. Did you know that beeswax is used in manufacturing carbon paper and even shaving cream?

Talk about "the busy bee"! I have yet to meet a beatnik bee. All sidewalk superintendents love to watch others work, but if you are nervous about being stung, quietly draw up a chair in the Library, it is thoroughly screened, and read about these interesting Hymenoptera. You will find it most rewarding.

Everyone knows about the Langstroth Bee Garden, but I wonder how many people realize that the Arboretum has a very fine collection of books on Bees and Bee Keeping.

The Reverend Lorenzo L. Langstroth was the Moravian clergyman, long a resident of Philadelphia, who in 1851, revolutionized bee-keeping by inventing the moveable-frame hive. The garden which bears his name was dedicated at the Arboretum in 1951 on the hundredth anniversary of Langstroth's epoch-making discovery.

There are many bee gardens in this country, but ours differs from most if not all of them in that the plants which it contains are trees and shrubs (as befits an Arboretum) rather than such herbaceous forms as alfalfa, clover and sage.

Under the able curatorship of Mr. Fred W. Schwoebel, a well-known apiarist, this garden has attracted much attention and has made a distinct contribution to the educational activities of the Arboretum. Many groups have held meetings in it and numerous persons have received instruction in the art of bee-keeping from the Curator.

Browsing through the Library of the Arboretum not long ago, I was struck by the large number of books in the section devoted to the art and science of Bee-keeping. I raised the question as to whether there was an organic relationship between the Bee Garden and the number of bee books in the Library. The answer was an unqualified yes.

Just as money breeds money and success begets success, so the existence of the Langstroth Bee Garden has appreciably stimulated the inflow of books on this subject into our Library. The first significant bequest occurred in 1962 when Mr. Christopher Percy took Dr. Fogg's summer course on Woody Plant Identification. It seems that Mr. Percy's grandfather, Mr. J. O. Enders, had been an ardent bee-keeper and had assembled an impressive collection of books and pamphlets on this subject. This collection had been left to his widow to dispose of as she saw fit. At her grandson's suggestion these items were offered to the Arboretum and quickly accepted. Today they constitute the nucleus of the Arboretum's Bee Library. More recently Mr. Schwoebel has donated his own collection of more than 75 titles to the Arboretum. Other volumes have come as a gift from Mr. Charles C. Norris and still others by purchase.

The collection contains several books dating from the eighteenth century. One of the oldest — a true classic — is Wildman's "Treatise on the Management of Bees" published in London in 1770. Another is "The Practical Bee-Master", by John Keys which was issued in 1780. Also included are several early editions of Langstroth's "The Hive and the Honey Bee" which appeared during the latter half of the last century.

A "Life of Langstroth" by Florence Naile contains much important information on the Father of Modern Bee-keeping and another very valuable work is Sladen's "The Humble Bee", published in London in 1912.

The collection also contains many modern books some dealing with honey plants, some with beeswax, others concerned with the chemical and biological aspects of bees and their work.

There must be many bee keepers in the Philadelphia area. I wonder how many are aware of the Arboretum's rich storehouse of books on this subject.

Marion W. Rivinus

Hybrid Sterility in Magnolia X Thompsoniana[1]

Frank S. Santamour, Jr.

The cultivar known as *Magnolia* × *Thompsoniana* (Loud.) Sarg. originated in 1808 as an off-type seedling in a group of *M. virginiana* L. being grown by a Mr. Thompson at Mile End in London (Fig. 31). In the years that followed its introduction, there was some dispute concerning its lineage. Loudon (1838), for instance, considered the plant to be a variety of *M. glauca* L. (= *M. virginiana*). There was less support for raising the variant to specific status. Sargent (1888) expressed the prevailing opinion that the plant was a natural hybrid between *M. tripetala* L. and *M. virginiana* and noted its apparent sterility and lack of hardiness. Nicholson (1895) stated that *M.* × *Thompsoniana* was probably a hybrid between *M. virginiana* and *M. Fraseri* Walt., but this appears unlikely.

Recent evidence has served to confirm the *tripetala* × *virginiana* parentage of *M.* × *Tompsoniana*. Santamour (1965) found leucocyanidin in the leaves of both the hybrid and *M. tripetala*, but not in *M. virginiana* or *M. Fraseri*. McDaniel (personal communication) has repeated the cross using *M. virginiana* as a female parent. Crosses utilizing *M. tripetala* as the female parent have not been successful. Thus it appears that although Sargent's opinion as to the putative parentage is correct, the proper notation should be (female parent first) *M. virginiana* × *tripetala*.

Although Sargent and others have mentioned the lack of fruitfulness of the hybrid, there has been no study to determine the causes of the possible sterility. McDaniel obtained some seed (later lost) when he pollinated *M. virginiana* with pollen of one of his *virginiana* × *tripetala* hybrids, so it is possible that sterility of the interspecific combination is not complete. The Arboretum specimen failed to mature a single fruit in 1965, even though hand-pollinated with pollen from several other species, including *M. virginiana* and *M. grandiflora* L.

Sterility in hybrids may be caused by physiological disturbances resulting in abnormal development of the sex organs or by failure of the meiotic process to produce viable pollen or egg cells. The present study was made to determine the cause of sterility in *M.* × *Thompsoniana*. Cytological examinations of meiosis in pollen-mother-cells were made using standard aceto-carmine squash techniques.

[1] With the support of a grant from the American Philosophical Society.

Fig. 31. *Magnolia* × *Thompsoniana* at the *Morris Arboretum*

Results and Discussion

The haploid chromosome number of the hybrid was n=19, as in the parents, thus eliminating the possibility that hybridization had been originally effected by a diploid gamete. However, only about 2% of the cells examined contained 19 bivalents (II). The majority of the cells (ca. 90%) were found to contain 18 II and 2 univalents (I), with one or two of the bivalents so loosely paired that the individual chromosomes were readily visible (Fig. 32a). Up to 6 I were found in other cells, and only infrequently was a multivalent encountered.

The major feature of meiosis in the pollen-mother-cell was the premature movement of univalents to the poles during very early anaphase. There also appears to be a precocious separation of some of the "loose" bivalents during this stage, so that from 1 to 6 univalents may be found outside the main body of the metaphase plate (Fig. 32b). Some of the precocious univalents become reconstituted with the telophase nucleus while others may remain outside the spindle during metaphase II (Fig. 32c), and are either lost in the cytoplasm or remain in place until cytokinesis.

Lagging of chromosomes is less common but occurred in about 15% of the cells examined. From one to three bivalents, and less often a univalent, may remain in the plate position during late anaphase (Fig. 32d). Similar disturbances were observed less frequently during the

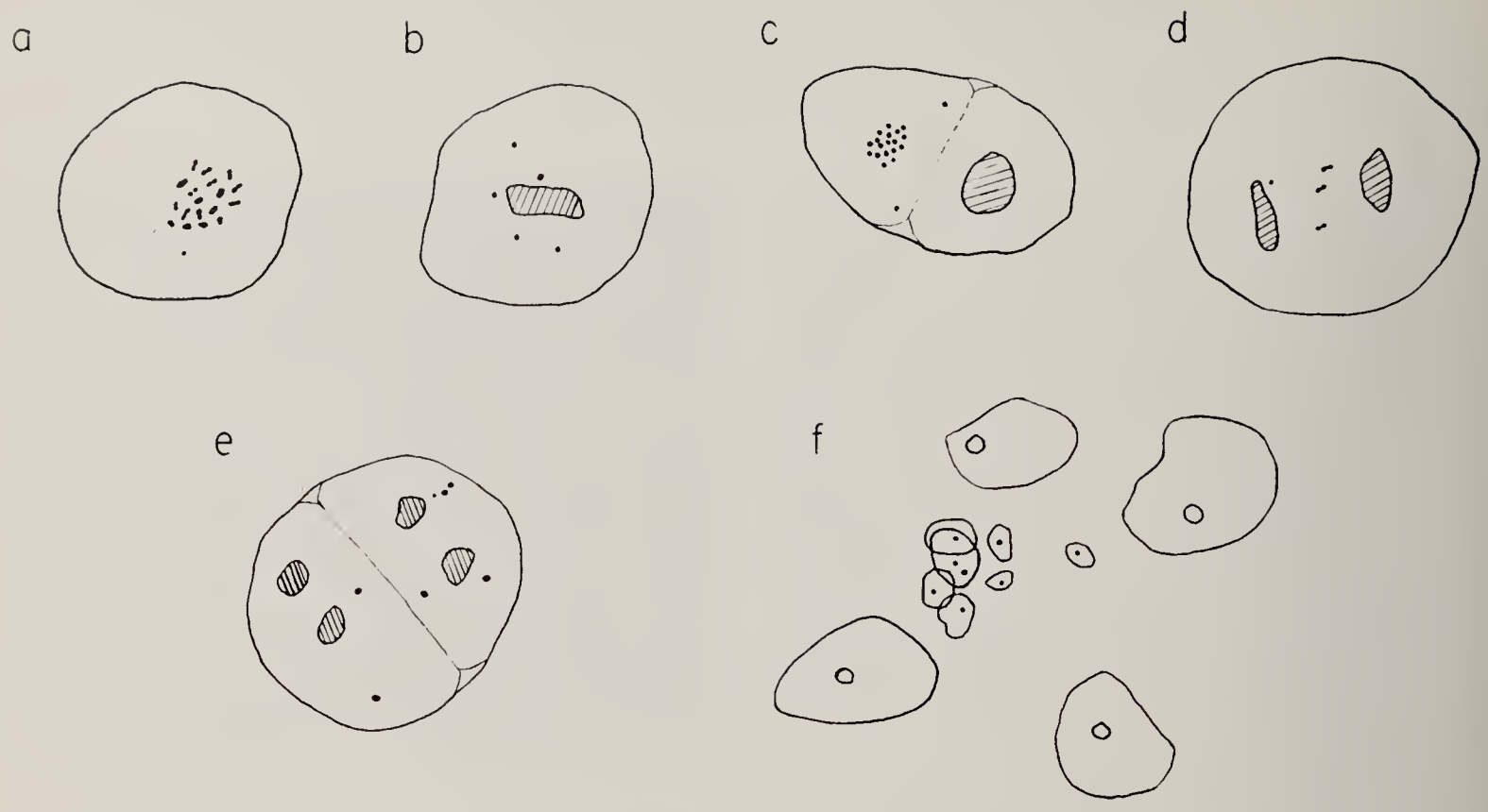

Fig. 32. Meiotic stages in *M.* × *Thompsoniana*
(a) metaphase I, (b) early anaphase I, (c) metaphase II, (d) late anaphase I, (e) telophase II, and (f) breakup of microspore "quartet". (575x).

second division, probably involving only those precocious or lagging chromosomes that were able to join the reconstituted telophase I nucleus. (Fig. 32e).

During cytokinesis these isolated chromosomes are cut off from the four major microspores and up to seven "dwarf microspores" may be seen. These abnormal microspores may contain either univalents or bivalents (Fig. 32f). Occasionally, some of the larger microspores may contain two or more nucleoli, but this may also occur in the parent species.

The phenomena of precocious migration of univalents and occasional lagging thus lead, in the majority of divisions, to microspores containing less than the normal (n=19) complement of chromosomes. Microspores with aneuploid chromosome numbers (n=16 to 18) do not continue development to become viable pollen grains, and the dwarf microspores abort soon after cytokinesis. Only about 1.2% of the pollen grains shed by *M.* × *Thompsoniana* appeared to be normal. This figure may be compared with data from individuals of the putative parents: 97% for *M. virginiana* and 89% for *M. tripetala.*

Although meiosis in only the pollen-mother-cells was studied, it is likely that similar abnormalities occur in the formation of the egg cell. The Arboretum specimen, perhaps a direct clonal descendant of the original, is thus highly sterile. It is possible, however, that other hybrids between *M. virginiana* and *M. tripetala,* which will necessarily involve different parental stocks, may show a higher degree of fertility and be useful in further breeding work.

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Notes on Acer Henryi

Patricia Allison

Late in April, 1966, two mature specimens of a remarkably interesting maple flowered in profusion at the Morris Arboretum. The two are relatively small trees; one, close to the woods and not far from the native azalea collection, has a main stem 12 to 14 inches in diameter. The other, on higher ground, has multiple stems of substantial girth. Both of them flowered when early maples had already finished but before expanding leaves could hide their display. The flowers themselves are nondescript, but in mass, the graceful light-green racemes are lovely.

The species is *Acer Henryi* Pax, a maple which at this moment is not known in cultivation in North America save for three papers emanating from this Arboretum in the fifties (12, 13, 14). Through some oversight, it was not included in B. O. Mulligan's Check List of maple species and varieties to be found in cultivation in the United States and Canada (6).

A. Henryi is native to high woodlands of central China. Two extraordinary young men are responsible for its being in cultivation. One of them was Augustine Henry, after whom Ferdinand Pax named the tree in 1896 (3). Henry, an Irishman, spent a long tour of duty in China in the last century as a medical officer and assistant in the Maritime Custom Service. Since his port was a full 1000 miles from the sea, and because his interest in botany burgeoned beyond any he might have held for medical practice, a great deal of his time was spent in collecting specimens of the rich flora of the orient that he recognized as important to botanical science (2, 3, 4). The dried examples that he sent back to England so excited the minds of their recipients that he was charged time and again to continue his collecting expeditions. Thousands of specimens were forwarded; hundreds of new species came to the view of western botanists, one of them Pax, who described *A. Henryi* (in Hooker's "Icones Plantarum" t. 1896 (1889)). Such was the interest evidenced by then, however, that English botanists and horticulturists desired living plants of the species that had been represented only by pressed specimens. So it was that a young student experienced in horticulture, E. H. Wilson, was sent to China by the distinguished firm of James Veitch and Sons to collect seeds and bulbs as well as additional herbarium specimens of the flora of China. His first expeditions were thus supported from England, and *A. Henryi* was introduced to cultivation there in 1903. His next, however, by virtue of a coup of supreme importance to American botany, were under the auspices of the new and already great Arnold Arboretum of Harvard University, whose founder and director, Dr. C. S. Sargent, was one of the giants of botanical history in the United States.

Wilson retraced many of Henry's steps, viewing specimens in flower, returning for their seed. It was Sargent himself who published the record of Wilson's collection of plants in 1913 (9), but another important botanist, Alfred Rehder, made the actual determinations of the Aceraceae recorded in "Plantae Wilsonianae." In it he mentions Wilson's collections by number. In May and June, 1907, five collections from Hupeh were pooled and given the number 424. One collection, undoubtedly of seed, was made in November, 1907, in woods near Hsing-shan Hsien at an altitude of 1700-1800 meters. This was assigned the number 424A.

Dr. Sargent relished the addition to western knowledge and gardens of the hundreds of new species that Henry and Wilson brought forth. He appreciated also other Americans who shared his interest in the new plant introductions from the orient. One of these was Mr. John T. Morris, whose sister, Miss Lydia Morris, shared her brother's horticultural enthusiasms and saw to it that the University of Pennsylvania would have an Arboretum. John Morris was determined to develop as extensive a collection of oriental woody plants as he could in Philadelphia. He and Sargent met and corresponded often. The Director of the Arnold Arboretum generously shared many of the plants or seed that came to Harvard. Among them was *A. Henryi,* recorded in the files of the Morris Arboretum as Wilson's collection 424A. Whether the specimens were received as seeds or as seedlings is not known.

Affinities of A. Henryi to other maples

The multiple-stemmed *A. Henryi* growing at the Arboretum was pictured in the Arboretum Bulletin in 1960 (5). Figures 33 and 34 in the present issue show the flowering habit and details of the inflorescence. Both trees bear only male flowers. Each flower is borne on a pedicel 1-2 mm. long that is subtended by a tiny bract. In some racemes the number of stamens in each flower is four, in others, five. Not infrequently

there is one flower with more stamens than the rest. This is nearly always at the tip of the raceme. The cupped, hairy sepals are opposite the stamens whose enlarged bases are inserted on the lobes of the disc. The greenish strap-like petals are situated between the stamens. In a depression in the center of the disc is a small papilla. The disc is moist when the flowers are fresh, but the odor of the flowers is not as pleasant as their appearance.

There is a fine photograph of a fruit-bearing branch in the Gardeners Chronicle (1). The foliage shown is trifoliolate, and the margins of the three leaflets are entire, as were those on the original pressed, nonflowering specimens upon which Pax based his description (7). The two Arboretum trees are quite variable in this leaflet character. Some are entire, others distantly dentate, others serrate-dentate. The indentations along the margins are not as deep and narrow as those of *A. cissifolium* (Sieb. & Zucc.) C. Koch, represented in the Arboretum Herbarium by specimens from tree 12478 of the Arnold Arboretum. *A. cissifolium* is similar to *A. Henryi* in many regards, and is a native of Japan.

Descriptions and viewpoints regarding the closeness of the relationship of *A. Henryi* to

Fig. 33. Inflorescences and developing leaves of *Acer Henryi*

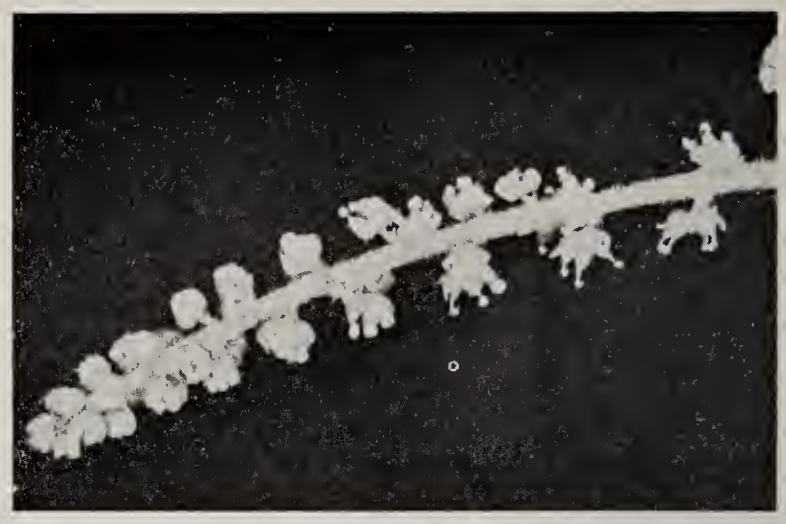

Fig. 34. Raceme of male flowers of *A. Henryi*

other maples have changed from time to time (2, 4, 7, 8, 9, 10, 11, 13). At first placed in Section Trifoliata (7), the species is now considered to be a near relative of the American species of maple with compound leaves, *A. Negundo* Linn. (10), and is included in the Section Negundo. Dr. Jonathan W. Wright supplied additional evidence for this transfer by making successful crosses of *A. Henryi* and *A. Negundo* (13). According to the same author, the chromosome number of *A. Henryi, A. Negundo,* and *A. cissifolium* is n=13 (14).

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Flower Show Exhibit

For the annual Philadelphia Flower Show, which was held from March 12 to 17, 1966, the Morris Arboretum prepared an exhibit of heaths, heathers, and related plants. This Heath Garden, as it was officially designated, was mounted in a square area, 20 feet on a side, which was bisected diagonally by a winding and ascending walk that terminated at the feet of a seated bronze statue of Mercury. (Fig. 35)

Two white-stemmed birches furnished points of emphasis on opposite sides of this walk and several of the taller azaleas provided an effective background for the display of the medium-sized and lower growing species in the foreground. (Fig. 36). 'Cornell Pink', at the height of its bloom, attracted much favorable comment.

Many of the plants in this exhibit had been removed from the Arboretum's Heath Garden, which was described in a previous issue of the Bulletin[1], and had been held in a cool greenhouse until such time as they could be forced into flower. Others had been lifted from various areas throughout the grounds and treated in the same manner. Still others had been obtained from nearby nurseries or donated by friends who were interested in participating in our effort. In all cases these plants have either been returned to, or will later be planted out in, our Heath Garden.

Although not in competition, this exhibit was awarded the Gold Medal Award of the Pennsylvania Horticultural Society.

As indicated above, most of the plants displayed in our Heath Garden were members of the Ericaceae or Heath Family. However, representatives of a few other groups which are frequently associated with heaths and heathers were incorporated into the exhibit. A complete list of the four score or so species shown is appended:

[1] Morris Arb. Bull. Vol. 17. 3-6. 1966.

Fig. 35. Heath Garden Exhibit of the Morris Arboretum at the Philadelphia Flower Show

Fig. 36. Detail of the Heath Garden

Andromeda polifolia nana
Arbutus Unedo rubra
Betula pendula
B. pendula oycoviensis
Bruckenthalia spiculifolia
Cassiope lycopodioides
Calluna vulgaris alba rigida
C. vulgaris aurea
C. vulgaris crispa
C. vulgaris cuprea
C. vulgaris 'Else Frye'
C. vulgaris Foxii nana
C. vulgaris 'J. H. Hamilton'
C. vulgaris 'Mrs. Pat'
C. vulgaris 'Mrs. R. H. Gray'
C. vulgaris 'Sister Anne'
C. vulgaris 'Tib'
C. vulgaris tomentosa
Chamaedaphne calyculata
Cytisus ratisbonensis
C. scoparia
Daboecia azorica
D. cantabrica
D. cantabrica atropurpurea
D. cantabrica Praegerae
Enkianthus campanulatus
E. cernuus rubens
E. chinensis
Erica arborea alba
E. arborea alpina
E. australis aragonensis
E. carnea aurea
E. carnea rubra
E. carnea Sherwoodii

E. carnea 'Snow Queen'
E. carnea Vivellii
E. carnea 'Winter Beauty'
E. ciliaris
E. cinerea alba
E. cinerea atrorubens
E. cinerea 'Golden Drop'
E. cinerea 'Golden Hue'
E. cinerea 'P. S. Patrick'
E. × Darleyensis
E. × 'Dawn'
E. mediterranea
E. terminalis
E. tetralix 'Pink glow'
E. vagans carnea
E. vagans 'Lyonesse'
E. × Watsonii
E. × Williamsii
Epigaea repens
Gaultheria nummularioides
G. procumbens
G. Shallon
Gaylussacia brachycera
Genista canariensis
Kalmia angustifolia
K. latifolia
Leiophyllum buxifolium nanum
Leucothoe axillaris
L. fontanesianum
L. fontanesianum 'Rainbow'
L. Keiskii
L. populifolia
Lyonia ligustrina
L. lucida
Oxydendrum arboreum
Pernettya mucronata
Phyllodoce nipponica
Pieris floribunda
P. japonica 'Bonsai'
P. japonica compacta
P. japonica 'Dorothy Wyckoff'
P. japonica pygmaea
P. taiwanensis
Rhododendron dauricum
R. mucronulatum 'Cornell Pink'
R. 'Ramapo'
R. 'Tan'
R. 'Wyanokie'
Vaccinium atrococcum
V. crassifolium
Zenobia pulverulenta

It is a pleasure to acknowledge the important assistance rendered by Mrs. Mark F. Emerson in the selection of material for this exhibit, as well as the untiring efforts of our Superintendent, Mr. John Dourley, and members of his staff.

J. M. F., Jr.

MAP SHOWING ACCESS TO THE MORRIS ARBORETUM, PHILADELPHIA, PA.

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Arboretum Activities

THE STAFF

The Director and Dr. Santamour represented the Arboretum at the Seventeenth International Horticultural Congress which was held concurrently with the annual meetings of the American Institute of Biological Sciences from August 15 to 20 at the University of Maryland at College Park, Maryland. On Tuesday, August 16, Dr. Fogg served as Chairman of a Symposium on the "Diverse Applications of Plant Taxonomy", a joint session of the American Society of Plant Taxonomists and the Systematic Section of the Botanical Society of America.

On September 14 the Director gave an illustrated lecture to the Providence Garden Club at Ridley Park, Pa., on the topic "Trees for the Small Home Site".

Dr. Li is continuing his studies on the Herbaceous Flora of Taiwan under a grant from the National Science Foundation.

Our Superintendent, John Dourley, gave an illustrated lecture to the National Association of Gardeners on June 9. His subject was "Drug Plants used in Modern Medicine and The Hallucinogens."

(Continued on Page 46)

A Philadelphian in Turkey

Edward Murray

For several years my interests have turned to the maples, a genus (*Acer*) of over one hundred species of trees and shrubs belonging to the horticulturally important Maple Family (or Aceraceae) which is distributed in the northern hemisphere with one equatorial species (*Acer laurinum*) in Indonesia. My interest in this group of ornamental woody plants has been fostered by four summers of study in the Morris Arboretum, by my good fortune in having held a Mercer Fellowship for three months at the Arnold Arboretum of Harvard University, and by graduate work, leading to the doctorate, which has been conducted at the Pennsylvania State University in University Park, Pennsylvania.

Feeling the need for an opportunity to examine type specimens in some of the great herbaria of Europe, as well as to carry on field studies in the Near East, I departed from Philadelphia in August of 1965 following the termination of the University of Pennsylvania's Summer Session. I embarked the next evening, August 13 by Icelandic Airlines for interesting Iceland.

Iceland

Reykjavik, the smokeless capital city of Iceland, is heated entirely by nearby hot springs. Not too many miles distant the awesome volcanic activity has built a new island. Bubbling mud oozes forth beneath noxious sulphurous fumes. Geysers spout steam and scalding water. Our word "geyser" is indeed derived from the Icelanic "geysir."

Fig. 37. Section of the Rock Garden at Edinburgh

Fig. 38. The Rhododendron Dell at Kew

Contrary to its name, only eleven percent of Iceland is covered by ice. Alpine plants cling to the shallow soil mantle in many places. Beautiful rock gardens are especially lovely in suburban Reykjavik. Sycamore maple (*Acer Pseudo-platanus*) and various mountain ashes (*Sorbus* spp.) are cultivated in the parks and gardens. Perhaps the very most charming place visited was the remarkable alpine gorge of Thingvellir. Here a number of circumpolar plants are tucked away in a natural rockery.

Great Britain

Scotland is but a short flight from Iceland. Edinburgh, its castled capital, is unique and impressive. The Royal Botanic Garden of Edinburgh is a gardener's paradise with a pageant of rare floral beauty. (Fig. 37) The gorgeous, glistening white edifice of the new herbarium and library facilitated the studies which began here in earnest, thanks to the kindness of the Regius Keeper, Dr. Harold Fletcher, and Drs. Peter Davis, Ian Hedge, Andrew Lauener, amongst others. The Chinese collections here are very important.

Fig. 39. View in the Jardin Botanique de Meise

Edinburgh memories lingered as the evening bus carried me south some four hundred miles to London. The Royal Botanic Gardens at Kew afford the study of many species type specimens in their large herbarium. Grateful thanks are due Sir George Taylor, Regius Keeper, as well as Miss Jarrett and Messrs. Meikle, Smith, Townsend, and the many other people whose kindness made for a pleasant stay. British hospitality is most agreeable warm and sincere. (Fig. 38)

Belgium and Holland

The Dover-Dunquerque ferry provided an eerie illumination of the white chalk cliffs at night. By early morning train the capital of Belgium was reached. The new location of the Brussels Botanic Garden at Meise, a fashionable suburb, is particularly outstanding. The former ducal estate enjoys velvet-green lawns and fine new conservatories. (Fig. 39) The new herbarium building will certainly vie with the one at Edinburgh for beauty. In the afternoon the collection of maples was studied at the old botanic garden herbarium in the city. The next day the Geographic Arboretum in suburban Tervuren met all the great expectations engendered by Dr. Fogg's illustrated lecture before the Philadelphia Botanical Club several years ago. (Fig. 40)

Fig. 40. View in the Geographic Arboretum in Tervuren

The Netherlands are but a few hours away. Leiden, the ancient university town, charms one with its canals. The famous Rijksherbarium houses the chief Malaysian collection in the world and faces on one of these delightful waterways. Sincere thanks are due the Director, Dr. Van Steenis, and Mr. Groenewegen and the helpful staff. Also of interest was the Hortus Botanicus of the University of Leiden (Fig. 41) which provided some exciting collecting of plant specimens for our Morris Arboretum Herbarium due to the kind consent of Mr. Van Hattum.

Fig. 41. The Botanical Garden at Leiden

Wageningen is the most famous college of horticulture in the Netherlands. Here a visit of several hours was made to the Belmonte Arboretum. (See Cover) In spite of the inclemency of the weather, several specimens were collected with the permission of Mr. Jansen, the Curator. A grand tour of the marvelous collections in the greenhouses was personally supervised by Dr. B. K. Boom (Fig. 42), author of Nederlandse Dendrologie.

Munich

The Bavarian kings encircled Nymphenburg Palace in suburban Munich with spacious gardens of which a portion has grown to become the famous Munich Botanic Garden. (Fig. 43) Besides the very great beauty and diversity of plant-life seen here, it was exciting to discover several isotypes of the Siebold collections received by Zuccarini from Siebold's Japanese quests. Especial thanks are extended to Dr. H.

Fig. 42. Dr. B. K. Boom in the Cactus House at Wageningen

Christian Friedrich for the use of the guest room for visitors which the Garden so generously provides. (Fig. 44) In addition, fine opera and magnificent art added to the enjoyment during this and two subsequent visits to Munich.

Vienna

In a few hours one can readily reach Vienna by rail. The Opera House, City Hall, Parliament, palaces and fine museums along The Ring were a delight once again to envisage. The Natural History Museum houses one of the grandest collections of the world's fauna and flora. Later I was to return here for a far longer sojourn. Because autumn was hurrying on, it was necessary to hasten in order to be able to collect foliage in Turkey rather than bare twigs.

Yugoslavia

On the evening of September seventh the express train took me to southern Austria and thence into Yugoslavia to the city of Zagreb. A long climb up the mountain to the north of Dolje-Zagreb provided the Norway maple (*Acer platanoides*) and sycamore maple (*A. Pseudoplatanus*) in a forest not far from gorgeous gentians and pink cyclamens. After the descent of the mountain and a brief visit in Zagreb, a night train was boarded for the mountainous interior of Yugoslavia. The next morning in Sarajevo a marvelous cable car took me to lofty Trebevich. From far above, the multitude of minarets in the city of Sarajevo below gave an oriental air. Several interesting collections were made here on the mountain top. After a fine luncheon in the restaurant with this magnificent view all about, the dessert Palatschinken was a fitting climax. That evening the train rolled on to Belgrade where a fine Hungarian Goulash was served in a restaurant near the train station. Then another train slowly chugged through to

Fig. 43. View in the Nymphenburg Botanic Garden, Munich

Fig. 44. The Laboratory in the Nymphenburg Garden, Munich

Nish where we soon left Yugoslavia to plod through Bulgaria on the one-car Orient "Express." After a number of hours had passed, we touched a little corner of Greece, and many hours later, reached our land of destination.

Turkey at Last

Istanbul is technically just inside Europe; but it is certainly more Asiatic than Singapore or Bombay! This city was the ancient Byzantium of the Byzantine Empire. Then Constantine created here the famed Constantinople. Justinian built Saint Sophia as the cathedral for the Eastern Church. The sultans of the Ottoman Empire brought wealth and power to erect the many beautiful mosques whose minarets soar above the high hills on which the city is built. Unique with six minarets, the famous Blue Mosque projects skyward, an immense dome adorned in the interior with blue and white tile.

Four huge columns about ten feet in diameter support the graceful vaulting.

Istanbul University has a botanic garden which overlooks the Golden Horn, an arm of the Bosporus, and the splendid Süleymaniye Mosque. Here Drs. Baytop and Demiriz were very cordial and helpful in my herbarium studies. About fifteen miles up the Bosporus and somewhat inland lies the Forestry College of the University near Büyükdere. Dr. Faik Yaltirik showed me *Acer Trautvetteri* and the hedge maple (*A. campestre*) amongst other native trees in the Belgrade Forest of the College. Dr. Kayaçik, the Director, kindly offered to write requests for assistance to his forest chiefs in northeastern Turkey which greatly facilitated my search for herbarium material.

Fig. 46. The Ruins at Baalbeck

The Bosporus to the Pontus

From Istanbul one crosses the straits of the Bosporus to Asia and drives through scenic mountains and broad plains with occasional herds of cattle to Ankara, the ancient capital under the Hittite Empire and the present capital under the republic. By bus we drove northeastwardly to Samsun and to Giresun on the beautiful Black Sea Coast. High above Giresun in the forested hills the chance sporadic bloom of the ochre-yellow *Rhododendron flavum* and the orchid-lavender *R. ponticum,* (Fig. 45) with leaves like *R. catawbiense,* reminded me of the beautiful native species such as *R. calendulaceum* and *R. maximum* which we so very much enjoy. This was reminiscent of the plant geography lessons of Dr. Fogg which emphasize the Asiatic–American counterparts. There at the top of a bald spot some dainty ladies'-tresses (*Spiranthes* sp.) grew in a moist place fed by waters percolating from the rocks.

Fig. 45. *Rhododendron ponticum*

Trees and shrubs abound in this well-watered, northern coast of Turkey—The Pontus. *Diospyros Lotus* reminded me of our persimmon, *D. virginiana*. Their commercially important "findik" (*Corylus Avellana*) is the hazelnut or filbert. Many acres of hillsides which are often too steep for ordinary farming produce hazelnuts for export. Another important crop near Rize on the Black Sea is "çay" or tea (*Camellia* (*Thea*) *sinensis*). Pronounce "çay" like "chi" in *chi*ves. This is an Arabic and Turkish word which has come to mean the same as "coffee break" to us. I digress to suggest that Associates of the Morris Arboretum will want to visit our handsome evergreen tea plant located at the foot of the holly slope not far from the Katsura tree. Although the Philadelphia climate was once said to not be conducive to its growth, the presence of tea is no less unusual than redwood (*Sequoia sempervirens*) in suburban Merion at the Barnes Arboretum. However, we doubt if tea will ever be exported from the Port of Philadelphia. Now our thoughts will return to those Turkish hillsides.

Chamlihemshin in the mountains of The Pontus is an unforgettable village some twenty miles south of Ardeshen in the valley of the Büyük Dere. From lofty precipices water leaps in delicate threads to meet the thunderous cascades which gush through the narrow gorge. This evidence of very abundant rainfall produces the mighty boxwood trees (*Buxus sempervirens*) gaily festooned with epiphytic lichens. The yew (*Taxus baccata*) appeared to be rare here with only one very old tree noticed. Brilliant scarlet pomes of the rowan tree or mountain-ash (*Sorbus aucuparia*) and vivid pink capsules of the spindle tree (*Euonymus europaeus*) gave splashes of color to the landscape. The Turkish maple (*Acer cappadocicum*) with its bloomy twigs grew

by the creek at 600 meters. Chamlihemshin and its valley are amongst the prettiest to be found.

Borchka and Artvin are immediately south of the Caucasus Mountains in Turkey. South of Borchka the Murgul Forest supports the growth of the "English" holly (*Ilex Aquifolium*) which appears to be very much at home in these Turkish woods. The laurel cherry or cherry-laurel (*Prunus Laurocerasus*) bears abundant fruit which the natives appeared to relish. Here it grew to be a small tree often to twenty feet. The Turkish ivy (*Hedera colchica*) climbs thirty feet up into trees and blooms profusely. Thanks to a young forester, several flowering branches were brought down to be pressed. Murgul Forest was yet another region of lush growth.

Artvin was to be the most northeasterly point which I reached. The mountain just west of the town was gradually assaulted until the dense rhododendron thicket appreciably slowed me down and a blueberry (*Vaccinium* sp.) was discovered to be most delectable.

South of Trabzon on the Black Sea one gradually climbs through the coastal mountain range whose seaward summit is bedecked with marvelous Oriental spruce (*Picea orientalis*). Beyond these green cathedral spires one all too quickly enters the dry interior with barren, rocky slopes until arriving upon the broad, treeless plain of Erzurum. After a few days, the scenic train rode through narrow gorges in central Turkey, where only the torrential river and the man-made rails dared to exist. This engineering feat, involving innumerable tunnels through solid rock, reminded me of photos of the Arkansas River Canyon in Colorado. Finally we arrived in Ankara. After a bit of sightseeing, I boarded a bus for the southeast. As it wended its way through the Cilician Gates of the famed Taurus

Fig. 47. Crusaders' Castle near Rhodes

Fig. 48. Avenue of Plane Trees in the Jardin des Plantes, Paris

Mountains of southern Turkey, I perceived the mighty vertical spires of the unusual Turkish Cedar (*Cedrus Libani* subsp. *stenocoma*) dominating the scene. Although many consider this tree identical with the Cedar of Lebanon, its very vertical habit in the wild as well as in cultivation in Philadelphia and Boston (at the Arnold Arboretum) attest to its singularity, since the Lebanese Cedar has such typically broad-spreading branches with a flattened top. Furthermore, at the Arnold Arboretum, only the Turkish Cedar will survive. The Cedar of Lebanon has repeatedly failed to grow that far north. Fortunately we are able to grow both for comparison in Philadelphia.

Lebanon

The bus connections through Turkey to Antakya (Antioch) are good. However, one frequently has to resort to the more costly taxi ride to reach the border and thence to the next important city in Syria, Latakia. One continues along the Mediterranean Sea to Lebanon, the city of Tripoli, and eventually the sweeping curve of land jutting into the blue water with sparkling white houses and modern hotels with hills and mountains in the distance brings one to Beirut.

About ten miles east in the hills at 800 meters elevation stands the village of Brummana which nestles amidst lovely pines. David Birkinshaw, a well-versed amateur botanist, and an assistant professor in the American University of Beirut took me botanizing in these interesting hills. Storax (*Styrax officinalis*), strawberry-tree (*Arbutus Unedo*), and *Rhododendron ponticum* subsp. *brachycarpum* grow beneath *Pinus brutia*.

The beautiful American University of Beirut campus offered many fine specimens for collecting through the kind permission of Mrs. Winnie

Fig. 49. The Alpine Garden at Geneva

Edgecombe, the plant taxonomist. Nearby Choueifat, about ten miles south of Beirut, yielded the evergreen Syrian maple (*Acer syriacum*) in fruit. A wonderful Sunday outing to the ancient ruins of Baalbeck to view the Sound and Light Spectacle will long be remembered. (Fig. 46). Other memories of Beirut include a long talk with Père Paul Mouterde whose life's work has centered on the flora of Lebanon and Syria which will culminate in a soon-to-be-published, personally illustrated work.

Return to Turkey

While retracing my steps along the Mediterranean through the Slenfe Forest of northern Syria, I stumbled by chance upon an unusual grey plant. Dr. T. R. Dudley, of the National Arboretum in Washington, D.C., has identified this as the uncommon *Alyssum crenulatum*. Such discoveries lend impetus to the exciting field of plant exploration and make all the effort more worthwhile.

Back in Turkey I visited the herbaria of the universities in Ankara and Izmir. At the University of Izmir, Dr. Constantine Regel, a relative of the famous Regel family of Saint Petersburg (Leningrad), greeted me cordially and indicated his desire to write a local flora for his students. This will be a pocket-sized flora and is not intended to compete with the monumental studies of Dr. Peter Davis of Edinburgh on the complete "Flora of Turkey."

South of Izmir the remarkable ruins of Ephesus showed early Greek influence. *Vitex Agnus-Castus* was still blooming here in October in spite of the very dry weather. The dusty roads became more and more rugged as we headed for Mugla for the night. The next morning was glorious as we descended the very twisty road towards the Mediterranean Sea. From the top of a high cliff we caught a glimpse of shimmering blue and cautiously slithered down the slope to a broad, fertile valley below. Now the road led across the valley beneath a superb canopy formed by a double row of chalky-barked eucalyptus trees. Then over some little hills and through some valleys filled with Oriental sweetgum (*Liquidambar orientalis*) we were jostled towards the quiet fishing village of Marmaris. Its sheltered bay of the Mediterranean is completely surrounded by heavily wooded hillsides which are replete with lovely flora. It was a thrill to see at first hand the Oriental sweetgum which is endemic to southwestern Turkey and the neighboring Isle of Rhodes. Marmaris is indeed blessed with a superb panorama.

Rhodes and Greece

The Dodecanese Islands are twelve Hellenic islets which have floundered between Turkish, Italian, and present Greek rule off the coast of Turkey. Rhodes is the chief of these and the most frequented due to its architectural heritage. The famous Knights of Saint John built the City of Rhodes as their magnificent fortress during the Middle Ages. (Fig. 47) With turreted ramparts and moats, chapels and mosques, narrow streets lined with shops of craftsmen, we are transported centuries into the past. Sidetrips to the Acropolis of Lindos and to the monastery of Philerimos provided marvelous vistas of the sea and the hills.

Athens was just as impressive this time. No one needs to exclaim further about the opulent architecture of the many Greek temples. The Parthenon speaks for itself. The numerous hills are covered with gleaming white dwellings which dazzle in the brilliant sun.

The rather new expressway leads north from Athens towards Thessalonica, the second city at the top of the Aegean Sea. Many attractive Greek Orthodox churches in Thessalonica are built in the traditional manner of the Greek cross. That of the Church of the Twelve Disciples is especially remembered. Taking our departure, we motored along the fine two-lane Autoput of Yugoslavia through Belgrade, Zagreb, and Ljubljana and through the glorious Austrian Alps where the European beech (*Fagus sylvatica*) was afire with copper and bronze. After a few days in Munich, I returned to Vienna.

Vienna

Through the kindness of Professor Rechinger, Director of the Natural History Museum of Vienna, my studies in the Aceraceae were to be put to the test. He asked me to spend several weeks in the herbarium to write the Maple Family for the Flora Iranica Project which involves a complete flora with descriptions and

keys to the identification of all the higher plants of Iran, northern Iraq, adjacent parts of Azerbaijan and Turkmenistan in the USSR, Afghanistan, Baluchistan and the most westerly mountains of West Pakistan. Altogether ten weeks were to be spent in Vienna. Hundreds of herbarium sheets were first annotated for the Aceraceae, the Oleaceae (Olive Family), the Elaeagnaceae, and also many sheets of *Rosa*. Then the sheets had to be arranged geographically before the keys to identification and the Latin descriptions could be written. This was certainly the opportunity of a lifetime to assist in a small way in this vast undertaking of Professor Rechinger, to whom much is owed.

London

In order to study type specimens for these several families, I decided to spend Christmas in London. Two weeks of intensive study in the wonderful herbarium of the British Museum of Natural History were made possible through the Keeper, Dr. Dandy, and Dr. Robson, Dr. Stearn, Miss Hillcoat, Mr. Williams, and many others. The Christmas holidays were very much enjoyed in the company of Dr. Lysaght and friends. Two additional weeks were taken in the herbarium at Kew with the permission of the Regius Keeper, Sir George Taylor, and his cooperative staff. Important Wallich types were studied through the aid of Mr. Smith. This work was especially important and stimulating.

Paris

A snowy blanket greeted me in Paris at the Natural History Museum. The Director of the division of higher plants, Professor Aubreville, and especially Dr. H. H. Heine and Mons. and Mme. Raynal are thanked most appreciatively for their gracious hospitality during two weeks in January. Apart from the interesting herbarium work with types of Michaux remembered most, the very old trees in the Jardin des Plantes evoked horticultural veneration for their sheer majesty. (Fig. 48) These were amongst the very first trees of their species cultivated in Europe. The black locust (*Robinia Pseudo-Acacia*) is particularly venerable since it was planted by Vespasien Robin about 1601. Thanks to the stimulating guided tours of these friends, Paris became a living museum of history both biological and monumental.

Fig. 50. Kew Gardens in the Spring

Geneva

Beside Lake Geneva is the Botanic Garden almost in the shadow of Mont Blanc which rises in the distance. The alpine garden is made to appear most natural and inviting and was already showing much color in late January. (Fig. 49) Especial thanks are due Professor Miège, the new Director, and Dr. Bonner who aided my studies of the deCandolle and Boissier material. It was simply enchanting to wander about the town to view the Lake, the narrow streets and quaint buildings, distant alpine peaks, verdant lawns, and to absorb the serenity and tranquility.

Florence

The intellectual capital of Italy has long been Florence. The fine, old University dates from 1321 and houses the most important herbarium in Italy. Here the Giraldi and Silvestri collections from China were carefully studied. Even now nostalgic moments recall the visits to the Uffizi Gallery, the Pitti Palace, the wondrous City Hall, the Ponte Vecchio, and the charming little streets of the old city.

Vienna to Utrecht

A return to Vienna for three weeks permitted the completion of a rought-draft of the Oleaceae paper for Flora Iranica. After farewells were said to Professor Rechinger, Dr. Harald Riedl, Herr Fitz, Herr Leute, Herr Tuisl, and other friends, three days were spent in the Munich Botanic Garden to complete the studies in their fine herbarium and to enjoy the awakening alpine garden with *Scilla Tubergeniana* absorbing the most attention. Soon the mediaeval walls of Nüremberg with its many fascinating turrets prompted one to dream of recreated glory since the many rebuilt portions had been copied so tastefully and painstakingly with every detail. Then Frankfurt was revisited and later Krefeld in the Ruhr from whence many followed Pastorius to Germantown, Philadelphia.

Utrecht University was next visited to study Miquel holotypes. Then a berth was secured on the Hoek-van-Holland to the Harwich steamer.

Britain

It was pleasant once again to hear the people speaking our mother tongue. Cambridge University was quietly restful with its velvet-green carpets and attractive daffodils (*Narcissus* spp.). Each college has its own delightfully personal campus which is tastefully landscaped and tidily manicured.

London was bursting forth with *Forsythia* and *Narcissus* — yellow, gold, and saffron. It was still March while winter yet lurked at home. How lovely to experience two springs this year! Kew was revisited for a third time with pleasure. (Fig. 50) Saint James' Park was aflutter with four pink pelicans.

Edinburgh Castle loomed above the moors with Arthur's Seat, the remarkable extinct volcano, another landmark. Magnificent early Asiatic *Rhododendron* spp. and hybrids created a fitting climax to these Eurasian studies. The entire Royal Botanic Garden of Edinburgh appeared to be a fairyland with a myriad florets of tints and shades of many hues such as scintillating scarlet, rich rose, luminescent lavender, delicate beige, and warm white. No more fitting recollection could be imagined to require my speedy return to the cultivated plant grandeur which is Europe and to the native plant bounty which is Turkey.

Arboretum Activities

(Continued from Page 38)

Sorry, No Quinces

In our issue of March, 1966, we extolled the superb jelly-making qualities of our large specimen of Chinese quince (*Chaenomeles sinensis*) and offered to distribute fruit, as long as it lasted, this autumn. Several requests have already reached us.

It is, therefore, embarassing to be forced to report that our tree has not borne a single fruit this season. This performance is of course comparable to that of many fruit-bearing trees which produce a fine crop one year and yield little or nothing the following season. If our tree conforms to this pattern we shall again be able to offer quinces in the autumn of 1967.

The Summer Course

For the twelfth successive year the Director, aided by members of the Staff, presented at the Arboretum a six weeks graduate level course on "The Identification of Woody Plants." Once again Mr. Edward Murray functioned effectively as Laboratory Instructor and Collector.

The class was composed of 30 students, the largest number in its twelve-year history. Sixteen of the members were high-school teachers of science, whose enrollment was made possible by grants from the National Science Foundation. Six were students in the University's Division of Landscape Architecture; for them this is a required course. The balance of the class was composed of graduate students who registered through the Office of the Summer School.

Members of the group learned to recognize over 500 species of trees, shrubs, and woody vines. This was accomplished by laboratory study, daily walks through the rich collections of the Arboretum and field trips to nearby areas of horticultural and botanical interest, including an all-day excursion to the Pine Barrens of New Jersey. Many members of the class assembled their own herbaria.

By the time they have completed this course the students are equipped to recognize every genus and most species of woody plants native to eastern temperate North America as well as most of the commonly cultivated exotic genera from other continents which are hardy in this area.

The Drought

Whenever Arboretum officials from this section of the country foregather these days the chief topic of conversation is the drought and its effects on our collections.

For the fifth summer in succession the Philadelphia area has been woefully lacking in precipitation, a deficiency which sporadic downpours have done little or nothing to ameliorate.

The total rainfall reported from Philadelphia's International Airport for June, July, and August came to a scanty 4.39 inches, which is 8.41 inches below the normal precipitation.

During August, which is usually one of our wettest months, the rainfall was only 1.63 inches, or 3 inches below average. On September 13 the total deficiency since January 1, 1966, was close to 12 inches. Then, on September 14, the area was the grateful recipient of a downpour of 4.71 inches — more than it had received during the preceding three and a half months. It was the heaviest rainfall in any 24-hour period since September 12, 1960.

Welcome though it was, it is doubtful whether this deluge will have served materially to alleviate the present crisis.

As is our practice, we shall make a careful study of the effects of this situation and report our findings in a future issue.

J. M. F., Jr.

Aesculus Glabra Found Reproducing in Eastern Pennsylvania

Philip R. Pearson, Jr.
Biology Department, Temple University

While surveying the floodplain vegetation of Wissahickon Creek during the summer of 1965, a stand of reproducing *Aesculus glabra* Willd. was discovered in Whitemarsh Township, Montgomery County, Pennsylvania. The bulk of the population occurs on a small island about one acre in area and 10 yards upstream from where the Wissahickon Creek crosses under Pennsylvania Route 73. The island, formed by siltation behind an old mill dam, and its neighboring shore are part of the 50-year floodplain mapped by the United States Army Engineers (1965) and have soils classified as Bowmansville silt loam by the Soil Conservation Service (R. Thompson, personal communication).

The initial identification of *A. glabra* was made by the author in late summer 1965 and confirmed in May 1966 when the species was in bloom by the author and Dr. John M. Fogg, Jr. Specimens are on file in the University of Pennsylvania Herbarium.

To my knowledge this is the only stand of *A. glabra* reproducing east of the Appalachian Mountains. Fernald (1950) gives the range of the species as "Woods and bottoms, western Pennsylvania to Iowa and Nebraska, south to Alabama, Mississippi, Arkansas, and Oklahoma." Gleason (1952) states a similar range which is "Moist, chiefly alluvial soil, Pennsylvania to southern Michigan and eastern Nebraska, south to Alabama, Arkansas, and Oklahoma." Harlow and Harrar (1959) say that the species's distribution is similar to that of *Aesculus octandra* Marsh. which they list as being in "Extreme southwestern Pennsylvania south along the Appalachians to eastern Tennessee, northern Georgia and Alabama, west through central Ohio to southern Illinois." Merz (1957) maps the range of *A. glabra* from southwestern Pennsylvania down the Allegheny Plateau front to northern Alabama and Mississippi; up to southern Illinois, central Missouri; south to northeastern Texas through eastern Kansas and Arkansas; and from eastern Iowa to northern Ohio. Grimm (1950) states the species's range as ". . . from southwestern Pennsylvania west to Iowa, south to northern Alabama and northeastern Texas." "In Pennsylvania it is *entirely limited* to the southwestern portion of the state, principally along the Ohio and Monongahela Rivers and their tributaries" (my italics).

The distribution of *A. glabra* in Pennsylvania as plotted by the University of Pennsylvania Botany Department is indicated by the circles in Figure 51. The 9 stations form the western part of the state (group A, Figure 51) are within the natural range of the species while the specimens reported from the other location were not recorded as coming from other than single individuals. The two samples recorded from Center and Mifflin Counties (groups B, Fig. 51) are not plotted along any major stream in contrast to the specimens from along major streams of their tributaries in York, Schuylkill, Berks, and Lehigh Counties (group C, Fig. 51). None of these latter specimens was recorded as a part of a stand although the possibility exists since the proper environment is present. The remaining samples in the southeast (group D) are from individuals. The triangle locates the stand described in this paper.

The 1965 survey of all the vegetation in the stand showed that buckeye had 10% of the basal area of trees 1 inch dbh and larger, that saplings (0.5 m tall to 0.9 inch dbh) were present and that 2% of the seedlings (<0.5 m tall) in the stand were those of *A. glabra*. Other dominant trees are *Fraxinus americana* and *F. pennsylvania, Platanus occidentalis,* and *Acer Negundo.* The two ashes in combination have 13% of the basal area and the other two species 10% and 38% respectively. Frequencies of the characteristic shrubs and vines were *Lindera Benzoin* 8%, *Rhus radicans* 80%, *Parthenocissus quinquefolia* 12%, *Lonicera japonica* 24%, *Vitis* spp. 4% and *Cornus racemosa* 8%. Prominent herbaceous species in the late spring were *Alliaria officinalis, Impatiens biflora, Geum canadense, Viola eriocarpa,* and *Urtica dioica.*

Figure 52 shows the distribution of the buckeye population on the island. The figures represent stems 3 feet tall and larger. Seedlings were

Table I.

Inches dbh	Number Stems	Percent Stems
<1	15	11.5
1-2.9	51	39.6
3-5.9	36	28.0
6-9.9	23	17.8
10+	4	3.1

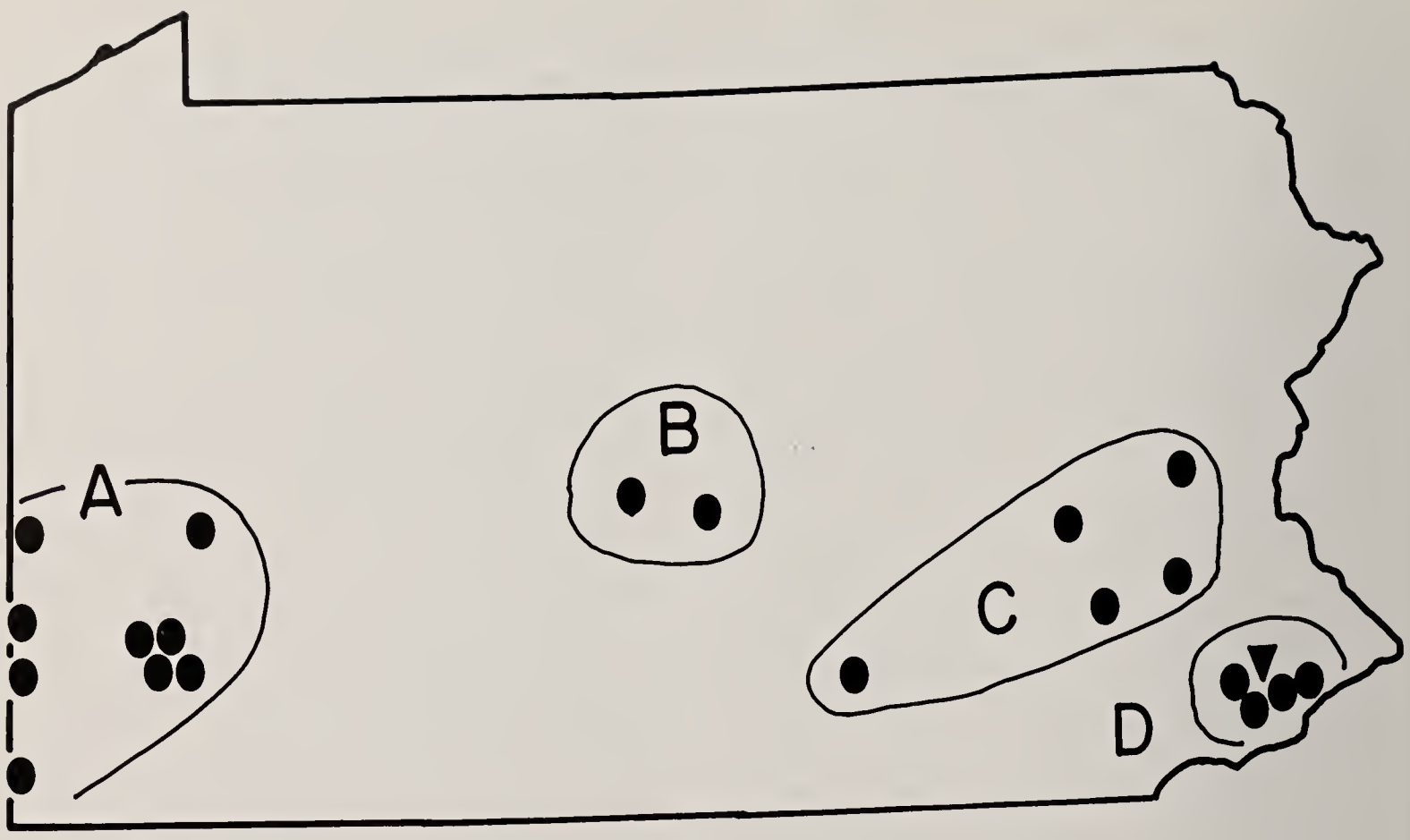

Fig. 51. Locations where *Aesculus glabra* has been collected in Pennsylvania. The triangle symbol indicates the general location of the stand described in this paper. This map taken from University of Pennsylvania map for the species's distribution.

common but heavy herbaceous growth prohibited an accurate count. The 129 stems mapped in Figure 52 have been divided into the five size classes seen in Table I. Two features of the population's distribution are particularly noticeable. One is the large double-trunked tree at location "A" where the two stems measure 14.5 and 15.4 inches dbh making it by far the largest individual in the stand. The second feature is seen along the eastern edge of the island where the stems labeled "B" are evenly spaced indicating planting sometime in the past. The second feature is quite obvious in the field.

The large central tree gives rise to the hypothesis that the plantings were made from seedlings of the old tree in some attempt to make a formal pattern. Enquiries into the island's history turned up no information other than the island had been "the way it is" since 1927. Increment borings from a large ash show that the central part of the island where buckeye are dense has been in existance since just before 1900. Whatever the sequence of planting and whether the original tree was itself planted or an escape from some unknown cultivation upstream is irrelevant in the light of the reproduction ranging from seedlings to trees.

In addition to the population mapped in Figure 52, there is a scattering of buckeye on the floodplain to the west of the island Most are either in the seedling stage or less than 2 inches dbh although one or two specimens up to 4 inches dbh were encountered. As might be expected many of these smaller trees are located along the upstream embankment of Route 73 where fruits and other debris lodge when there is high water.

The tendency of flood water to influence distribution can also be seen in Figure 52. On the western part of the island, a cluster of trees lies just beyond a scouring channel at the end of the dam. The dam, silted to the brim and with only from 2 to 4 feet of its face exposed has apparently tended to divert the floodwaters toward the eastern channel with the resulting concentration of reproduction in the "downstream" direction from the tree at "A". Also the vegetation is thicker on this eastern part of the island providing more places for the increased litter to lodge and retain buckeye fruits. The tail of the island supports only a few stems which, with two exceptions, are under 3 inches dbh. This contrasted to the distribution immediately above the dam indicates that the diversion action was effective until recent years.

Fig. 52. Distribution of *A. glabra* on island in Wissahickon Creek. The current flows from the top of the figure around the sides of the island as indicated by the dashed arrows. The dam is represented by the line across the islands center. The long tapering downstream end of the island is not shown here.

During the spring of 1966 the small understory buckeyes have grown from 1-2 inches in length, the intermediate sized trees from 2-4 and the larger stems with crowns exposed to sunlight 4-10 inches. This supports Merz's (1957) statement that the species is intermediate in tolerance and can support itself in competition with other bottomland trees. A reconaissance did not reveal any buckeye for 200 yards downstream from the barrier of the Route 73 bridge and embankment. Most of the land downstream from this barrier is either high or is maintained in artificial grasslands. Thus at this writing I have not located any *A. glabra* growing downstream from the Route 73 bridge. The general use of the floodplain for other purposes seems to limit any future downstream spread of buckeye to occasional streambank trees.

In concluding I would like to express my appreciation to Temple University for the summer research grant which made the Wissahickon vegetation studies possible and to Dr. John M. Fogg, Jr. who kindly made the records of the University of Pennsylvania available to me.

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The Anthocyanin of Chamaecyparis Conelets

Frank S. Santamour, Jr.

Anthocyanins are fairly common, but seldom noted, in the conelets (strobili) of many of the conifers. An earlier report (Hayashi and Abe, 1953) identified cyanidin 3-glucoside in a single species of pine. Recent work by the present writer (Santamour, 1966) has established that the 3-glucosides of cyanidin and delphinidin were the only anthocyanins found in the conelets of 35 species of six genera of the Pinaceae.

Male conelets of certain species and cultivars of *Chamaecyparis* (Cupressaceae) may also show red pigmentation. Conelets of *C. Lawsoniana* (A. Murr.) Parl., *C. obtusa* (Sieb. & Zucc.) Endl., and *C. pisifera* (Sieb. & Zucc.) Endl. cv. 'Plumosa Argentea' contained the same anthocyanin, which was analyzed by paper chromatography and absorption spectrophotometry. The R_f values were 0.63 in BAW and 0.18 in 1% HCl after ascending development on Whatman No. 1 paper. Hydrolysis in aqueous HCl yielded only cyanidin and rhamnose. Maximum absorption in the visible range was at 526 mu and the ratio E 440/E max was 24 percent. The anthocyanin was thus identified as cyanidin 3-rhamnoside. This pigment was first found in *Lathyrus odoratus* (Harborne, 1960) and is otherwise known only from *Plumbago rosea* (Harborne, 1962).

The discovery of this relatively rare pigment in a conifer should not, perhaps, be surprising in view of the presence of the flavonol quercetin 3-rhamnoside (quercetrin) in the foliage of both *Chamaecyparis* and *Thuja* species (Hattori, 1962). Quercetrin was also found in the male conelets in the present study.

The glycosidic patterns of flavonoids may have taxonomic significance and very often both anthocyanins and flavonols from the same plant have similar patterns. It is likely that additional sources of cyanidin 3-rhamnoside will be found when more quercetrin-containing species are investigated.

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New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since June, 1966:

Mrs. Edward C. Cassard
Mr. John I. E. Day
Mr. John E. Horn, Sr.
Mrs. Gilbert Klausner
Mrs. H. Martyn Kneedler
Mrs. Leicester S. Lewis
Dr. & Mrs. Jack B. McConnell
Mr. Paul McLaughlin
Mrs. Edward F. Miller
Mr. G. Fairman Mullen
Mr. William C. Newhard
Mrs. Harriet Pattison
Mr. Earl Robinson, Jr.
Mr. Milton Rothburd
Mr. James E. Sax
Mr. Gordon S. Smyth
Mrs. Julia C. Wessell
Woodrow Wilson High School

Cytological Notes III. Magnolia pyramidata, M. cylindrica, and M. guatemalensis[1]

Frank S. Santamour, Jr.

The chromosome numbers of a great many *Magnolia* species and cultivars have already been reported[2], and few of the cultivated types remain to be counted. Cytological studies were made on the above three species as a part of the genetical evaluation of this genus now being undertaken at the Morris Arboretum.

Chromosome number determinations were made from root tips derived from plants as received by the Arboretum or from rooted cuttings of such plants. Standard aceto-carmine squash techniques were used in all cases. Individuals of all three species were found to be diploid with 2n=38 chromosomes.

M. pyramidata Bartr. (M62-7) (2n=38) is the only Magnolia native to the United States that had not been reported earlier. This species is closely related to both *M. Fraseri* Walt. and *M. tripetala* L., which are also diploids. Our specimen was collected from the wild about six miles west of Hornbeck, La. by Dr. George H. Ware,

Department of Biological Sciences, Northwestern State College, Natchitoches, Louisiana.

M. cylindrica E. H. Wilson (M62-110) (2n=38) is closely related to *M. stellata* (Sieb. & Zucc.) Maxim. and other members of the section *Buergeria*. All members of this section are diploid. The Arboretum specimen was a gift from Mr. Henry Hohman, Kingsville, Maryland.

M. guatemalensis Donn. Smith (M 66-384) (2n=38) is an evergreen species from Guatemala, and was obtained through the courtesy of the U. S. National Arboretum (NA #26490). Of the section *Theorhodon,* comprising the evergreen species of the New World, the two most northern species are hexaploids. These are *M. grandiflora* L. of the southern United States and *M. Schiedeana* Schlecht. from Mexico. The only other species reported, *M. Hamori* Howard from the Dominican Republic, is a diploid.[3]

Actually, Howard considers the West Indian species sufficiently distinct from those of the mainland as to form a subsection or group. Cytological analyses of the New World evergreen species, in conjunction with taxonomic studies, should be especially interesting.

[1] With the support of a grant from the Michaux Fund of the American Philosophical Society.

[2] Janaki-Ammal, E. K. The race history of the Magnolias. Ind. Jour. Genet. Pl. Breed. 12: 82-92. 1953.

[3] Howard, Richard A. The Morphology and systematics of the West Indian Magnoliaceae. Bull. Torrey Bot. Club 75: 335-357. 1948.

New Combinations of Asiatic Subspecies of Acer

Edward Murray

As a result of the studies in European herbaria and the herbaria of the Arnold, Morris, and National Arboreta, the following new combinations are indicated for these Asiatic subspecies of *Acer*:

A. cissifolium (S. & Z.) K. Koch subsp. **Henryi** (Pax) E. Murray, Comb. Nov.
Syn.: *A. Henryi* Pax in Hooker f., Icones Plantarum *19*: t. 1896 (1889).
Typus: (Henry #5644). Two male trees are cultivated in the Morris Arboretum.

A. caudatum Wallich subsp. **ukurunduense** (Tr. & M.) E. Murray, Comb. Nov.
Syn.: *A. ukurunduense* Trautvetter & Meyer in Middendorf, Reise Sibirien 1 (2): 24 (1856).
Typus: "In montibus Ukurundu. . ." *LE,* non vidi.

A. tegmentosum Maximowicz subsp. **Grosseri** (Pax) E. Murray, Comb. Nov.
Syn.: *A. Grosseri* Pax in Engler, Pflanzenreich, IV, 163, Heft *8*: 80 (1902).
Typus: (Giraldi #2121) *FI!*

These subspecies are native to Northeastern Asia and are sometimes cultivated.

Associates' Corner

So You're Leading a Garden Tour[1]

"Dr. Fogg, would you consider leading a horticultural tour to Europe?" "Lead a tour! I wouldn't consider being a member of a tour." Such was the reaction of my husband when approached by the management of a tourist agency.

Later, when the question was repeated by members of his classes at the Barnes Arboretum, he began to consider the possibilities.

The students claimed that they themselves could enroll the necessary number of participants; the agency promised my husband complete freedom from responsibility in all travel arrangements — hotels, planes, buses, baggage transfer, etc. — provided he would plan the horticultural itinerary and conduct the garden sight-seeing.

Since we were ignorant of the pitfalls in such a proposition, we innocents ended by accepting the invitation to take other innocents abroad. Two trips later, we are no longer so innocent. Perhaps one of you one day may think of leading a horticultural tour abroad and might profit by some of our experiences.

My first words of advice to the prospective "tour director" are "Don't trust those who promise to fill your tour without effort." Yes, all their friends want to go but "not in May — we really can't leave our own garden then!" "Our children are still in school." "Our son is graduating from U.C.L.A." "We'd love to go with you; could we meet you in Vienna after a short trip to Italy?" "Could we stay over after the conclusion of the regular trip?" These latter requests make it difficult for the travel agent to give a package rate.

So our first planned trip fell through for lack of applicants. We found ourselves working very hard for the success of the second, bringing in at the end many non-horticultural Fogg friends and relations, and only on the third venture was it really easy, although here, too, we had many who went along "just for the ride."

Since our two horticultural tours were Europe-based, it was not difficult to provide attractions for the non-garden minded members. But these latter were invariably wonderfully agreeable people who spent hours in the gardens (even the husbands of garden club ladies) with the rest of us. Perhaps they had more freedom to enjoy the wealth of beauty than the ardent horticulturists straining to learn the new names and sort strange families into their proper systematic locations.

Now let's consider the agency's promise. "You provide the gardens, we'll take care of all travel and hotel details." If your group is lucky in its courier, the guarantee holds. On our first trip, we were met at Vienna by Otto who, until he put us in the plane in Paris three weeks later, managed us, our tickets, our transportation, our baggage, our individual requests, and problems with the ease of a circus master, all the while dispensing very intelligent information on history, music, theatre — almost anything except botany. We never saw our tickets nor our passports; we never handled a bag.

On the other hand, in Spain, we were in the hands of a reluctant hidalgo. It was demeaning to his aristocratic blood even to accompany us and surely business details were not in his line. An expert in Spanish art, he obviously considered us "locos", as we chose to wander around gardens rather than spend all our time with El Greco, Velasquez, etc. It ended by the horticultural director having to assume responsibilities for everything from assigning hotel keys to checking on air flights.

It should be admitted at this point that the success of a guided tour is greatly influenced by the general state of tourism in the country being visited. Our first trip to Austria, Germany, Holland, Belgium, with a few days in France, rolled along without a hitch. These are countries used to catering to tourists.

On our second tour we found Spain and Portugal still not ready to cope with the enormous invasion of spring visitors. Certainly last May these countries were bursting at the seams. Adequate hotel space was hard to find; several times our group had to be lodged in separate hotels, thus creating a problem in logistics.

Horticultural tours must of necessity plan to visit garden locations at the best blooming time. Your group will have a scientific as well as an esthetic interest in the gardens but other people, including the natives, are also drawn to the area at the seasons of greatest beauty. You must not avoid lovely places just because the tourist facilities will be overtaxed; rather you should begin

[1] This account appeared in the Quarterly Newsletter of the American Association of Botanical Gardens and Arboretums for July, 1966 (No. 67), and is reprinted here by permission of the Editor.

planning at least a year ahead of time. We started to organize in September for a May trip to Spain and Portugal, and it was too late to secure the best arrangement. We almost missed being located at Reid's Hotel in Madeira. What a catastrophe that would have been!

If you are thinking about leading a tour, you will wonder, as we did, about the disadvantages of traveling with a large group. Disadvantages do exist. When our travel agent requested a block of thirty-three seats in the plane from Lisbon to Seville, he was told by Iberia, "We can't give you that many seats; there wouldn't be enough left for individual passengers." So we took a three-corner trip, stopping some hours in Madrid. Our schedule included a train ride from Seville to Granada, but there were seats only for twelve passengers! We took a public bus and enjoyed the experience.

Most of the difficulties which we apprehended turned out to be nonexistent. Would the members of such a large group all be ready to meet appointments on time? Would they dutifully have their bags packed and outside the door by 6 A.M.? They were and they did. (By the way, why do all planes in Europe depart at 8 A.M.?) Our 89-year old member was usually downstairs before the dining room was open.

My husband and I had traveled widely on this globe, and we had always gazed with horror and a smug feeling of superiority on large groups of people in museums and castles striving to see the object in question and to hear the guide's words of wisdom. Would there be similar scenes in the gardens we would visit? Should I provide my husband with a megaphone? We soon found that, once in a garden, the group tended to fan out and that plants could be seen and comments heard with no difficulty at all.

We were blessed on both trips with congenial people. The "horts" and the "non-horts" (to steal categories from Nancy Mitford) were united in one respect. Neither group wanted to miss anything that was going on. Thus the non-horts duly accompanied the horts on every garden trip, and I must say they came home knowing and caring more about plants than when they left home as "average" tourists.

Expecting that the non-horts would soon think, "Not another garden!" we provided in our programming many extras in the way of typical sightseeing. We offered these and the regular garden excursions on an either-or basis. We now know human nature better. There was almost one hundred per cent attendance at the gardens; likewise in the museums, castles, and cathedrals.

This meant that the schedule was consistently jammed. As a result we were always breathless, often dog-tired, and never satisfied that we had enough time in any one place. The tourists, horts, and non-horts, who complained most about the hectic schedule, were those who voluntarily extended their "exhausting" days by dining at glamorous restaurants, most of which do not service until 10 P.M.; who went to concerts, marionnette shows, gypsy and flamenco dancing, all of which are scheduled much later than similar events here. We had not included a bull fight in our plans, but most of our travelers found their way to the bull ring and are now patting themselves on the back because they saw the great Cordobés.

When you start planning an itinerary, you are determined not to clutter it with too many activities. It will proceed at a comfortable pace; it will be leisurely. By the time the program is in print, it is twice as big, and many unscheduled events will surely be added. The program calls for visits to gardens and experimental stations near Ghent and Bruges. No one in his right senses can pass by these charming out-of-the-world towns without demanding that the bus stop there.

My advice when you are concerned about the weight of your schedule is . . . just don't worry! Sure, your itinerary is too crowded; no, you haven't enough time at this or that place; yes your "horts" will want to do almost as much sightseeing as if the trip were not labeled horticultural. Somehow or other the group strength will hold out to the last day. Total collapse will come only the first day home and perhaps reproaches for too hectic a trip, but no mention of what could have been omitted.

Here are a few tips to make your tour-conducting easier. Have all "extras" included in the price of the trip. Our members on the first tour never understood the "garden or sight-seeing" angle and resented paying for the side trips.

Explain to your members that most European hotels insist on demi-pension. This sometimes means giving up a hotel meal without rebate, if they wish to try a regional restaurant. Tell them that coffee is not included in the meal (this was astonishing to many on our tour); that dinners all over the continent will be much later than the time to which they are accustomed at home.

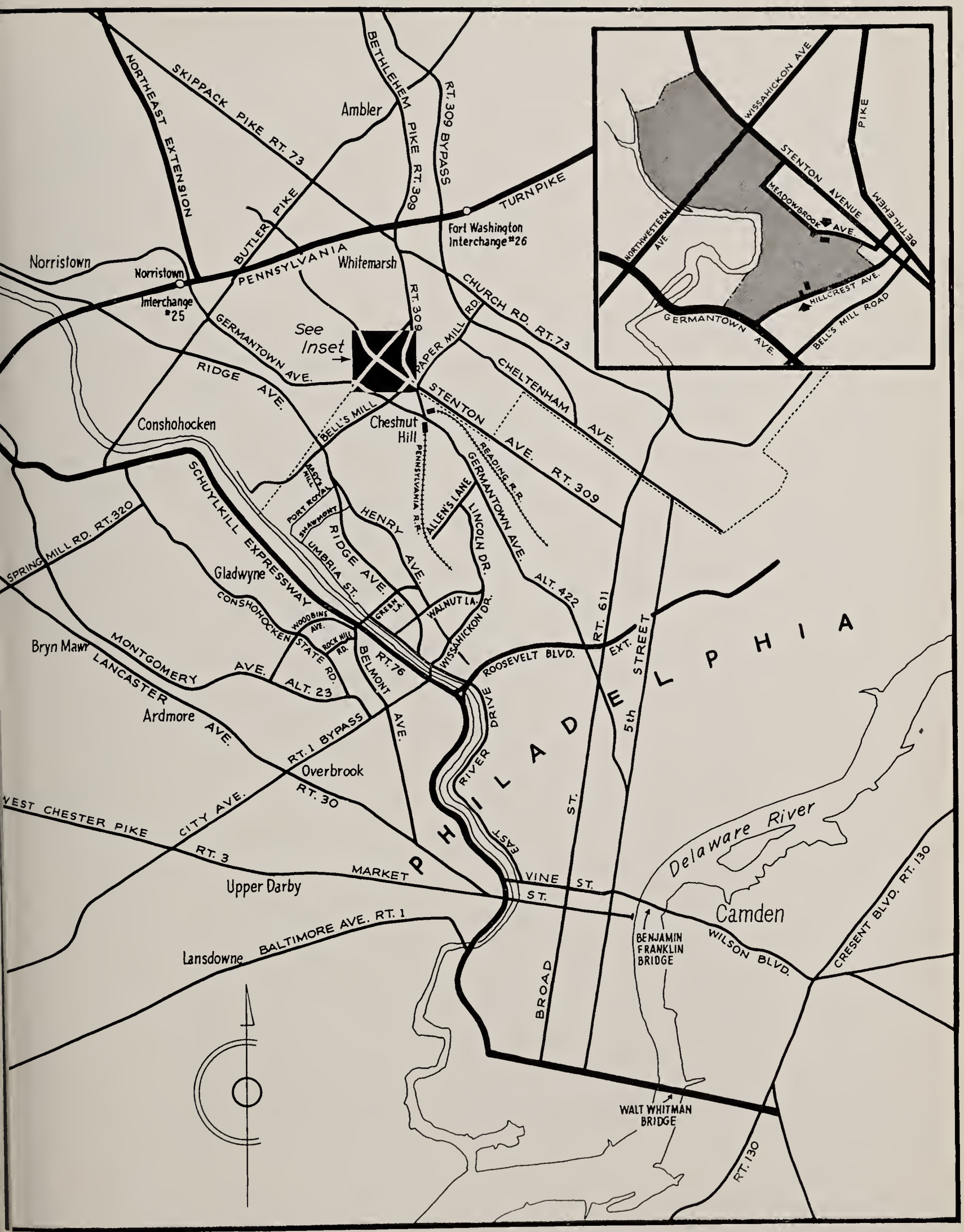
Tell them the nice things too: that traveling with a horticultural group means having the red carpet rolled out for garden visits. My husband had been in communication with the Directors

of the botanical gardens at Munich, Amsterdam, Utrecht, Wageningen in Holland; Brussels, Kalmthout, Tervuren in Belgium; Lisbon and Coimbra in Portugal and Madrid in Spain, as well as appropriate officials in many other institutions and parks. Thus there would always be someone expecting our visit and ready to expend time and effort on our behalf. Occasionally, a director of a garden accompanied us to another site.

Tell your tour members not to worry about their inadequacies in French, German, Spanish, etc. Fortunately, plant language is Latin and in the well-labeled gardens of Europe they will see the names to which they are (or should be) accustomed. Only the common names will be in the vernacular.

The rewards of leading such a trip are many. A trip with an object always seems ten time as pleasant as aimless sight-seeing. Kinship with fellow members becomes much greater because of the interests held in common. And, to prove it, there is a great clamor for a third European trip.

Helen B. Fogg



MAP SHOWING ACCESS TO THE MORRIS ARBORETUM, PHILADELPHIA, PA.

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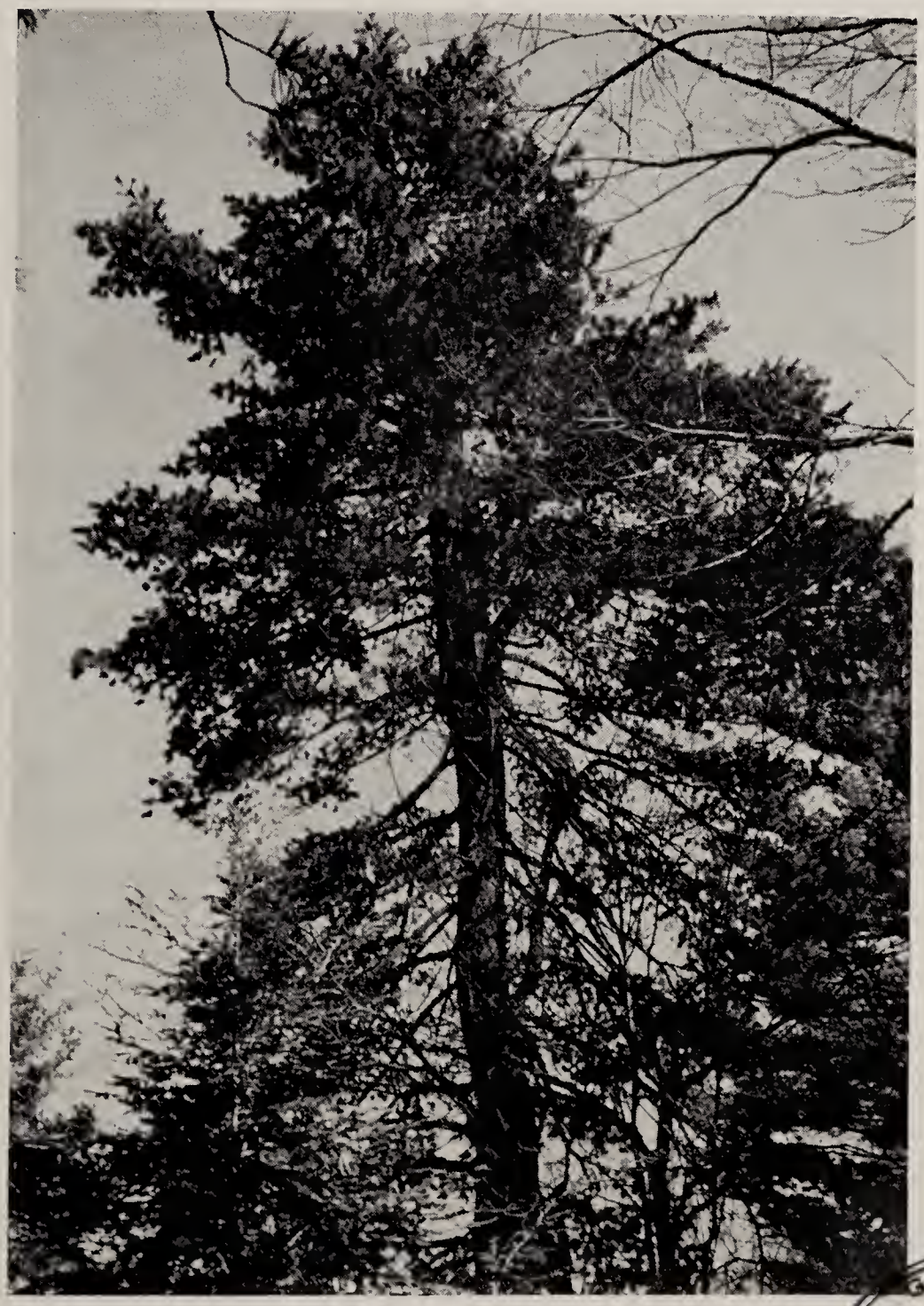

Pinus Lambertiana

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Arboretum Activities

THE STAFF

On October 10 the Director delivered an illustrated lecture entitled "Flowering Trees for Small Gardens" before the members of the Delaware Valley Garden Center at Berwyn, Pa., and on October 17 he spoke to the Wissahickon Garden Club on the topic, "Native Trees and Shrubs for our Gardens."

At the Brooklyn Botanic Garden, on October 24, Dr. Fogg conducted an all day short course entitled "How Plants are Identified," and at the regular monthly meeting of the Philadelphia Botanical Club, October 27, he presented an illustrated lecture on, "Some European Botanical Gardens."

On November 10 the Director spoke to the Old York Road Garden Club on "Trees of the Delaware Valley", on November 13 he was the featured speaker at the monthly meeting of the Philadelphia Chapter of the American Cactus and Succulent Society, which was held at the Morris Arboretum, and on November 21 he gave an illustrated talk to The Garden Workers on "New and Unusual Trees and Shrubs."

(Continued on Page 68)

A Sugar Pine Grows in the Philadelphia Area

Frank S. Santamour, Jr.

Sugar pine (*Pinus Lambertiana* Dougl.) is the largest member of the genus *Pinus*: a maximum height of 246 feet and diameters of 10 feet have been authenticated. The oldest specimen thus far determined by actual counts of annual rings was 623 years old.

The natural range of this majestic species is from the central Cascade Mountains of Oregon, south through the Coast Ranges and Sierra Nevada of California, with scattered outposts in extreme southern California and one area in Baja California, Mexico. It is never found below 1000-foot elevations and seldom below 2000 feet. In the San Pedro Martir Mountains of Baja California, this species occurs at elevations of up to 10,000 feet.

Fig. 53. *P. Lambertiana* showing double trunk

Fig. 54. Cone of *P. Lambertiana*

It would seem natural that botanists and foresters along the East Coast would try to introduce this magnificent species into their region. How early and how many were the attempts, we do not know. Failures of plant introduction are seldom widely publicized. We do know, however, of the limited successes. Dr. Jonathan W. Wright, in a survey of soft pines in the Philadelphia area,[1] reported that no mature sugar pines were found in the area and that he had failed to grow young plants past 4 to 5 years of age. Dr. Wright was quite knowledgable about the many arboretums, botanic gardens, private estates, and university and government plantings along the eastern seaboard, but the only mature sugar pines he reported were two old grafted (on *P. Strobus* L.) specimens at the Arnold Arboretum in Boston, Massachusetts. Since his paper was published, no new evidence of mature sugar pine in the East has come to light. There are, however, many young trees now under trial in a variety of situations throughout the region.

Why sugar pine does not survive or grow well in the Northeast is not well understood. The rainfall of the region is sufficient and the winters are not too severe for the species; sugar pine can tolerate temperatures down to -30° F.

[1] Wright, Jonathan W. Characteristics and identification of the soft pines cultivated in the Philadelphia area. Morris Arb. Bull 9: 19-30, 45-47, 1958.

It has been our experience that most of the conifers of the Coast Ranges and Sierra Nevada perform poorly in this area. When, however, a species has a range encompassing either of the preceding Ranges, as well as the Rocky Mountains (e.g. *P. ponderosa* Laws.), the Rocky Mountain ecotype invariably grows best in the East.

The largest pine in the world also produces one of the largest pine cones — up to 26 inches long. It was the sight of one of these cones that prompted David Douglas, pioneer botanist of the Northwest, to search for the trees that produced it. On September 26, 1826, Douglas finally found a stand of sugar pine near Roseburg, Oregon. The sight of a large and unusual cone also stimulated the Arboretum personnel to the first authentication of a mature sugar pine in the Philadelphia area.

The cone was brought to the Arboretum in July, 1966, by Mr. Edward Starr, III, a student in Dr. Fogg's summer course, who collected it from a large tree growing on his property in Bryn Mawr. Our first guess (which should serve to argue against first guesses) was that the cone came from one of the several varieties of the Mexican species, *P. Ayacahuite* Ehrenb., some of which are known to be hardy in the Northeast. However, after visiting the tree and performing a more detailed morphological and anatomical examination, the only conclusive identification that could be reached was "sugar pine." (See Cover and Fig. 53).

The Bryn Mawr specimen has several characteristics that do not conform to the "textbook" description of sugar pine. The cones are shorter (less than one foot) than the average for the species and the tips of the cone scales are decidedly reflexed. (Fig. 54). In addition, the true-green needles lack the bluish to silvery sheen mentioned in most descriptions. The major morphological features by which the specimen was identified (in contrast to *P. Ayacahuite Veitchii* Shaw) were the extremely long peduncles (cone stalks — up to 8 cm. long) and the presence of stomata on the dorsal surface of the needles.

When measured in November, 1966, the Bryn Mawr sugar pine was 70 feet in height and had a diameter at breast height (4.5 feet above ground level) of 35 inches. No determination of age was attempted and Mr. Starr could provide no information regarding the past history of the tree. Certainly the tree cannot be more than 140 years old (1966-1826 = 140), although comparison with data compiled by the U. S. Forest Service[2] indicates that trees of such diameter are commonly 120 years old on good sites. The height of the Bryn Mawr tree is, of course, not in proportion to its diameter. In western forests a tree with a diameter of 34 inches may be more than 150 feet tall. Judging from its present location, the local specimen has remained relatively free of competition throughout most of its life. Regardless of its age and past history, the sugar pine of Bryn Mawr is an important and unique addition to the exotic flora of the Philadelphia area.

[2] Forest Service, U. S. Dept. Agr., Silvics of forest trees of the United States. Agr. Handbook No. 271, 762 pp.

New Associates

The Arboretum is happy to welcome the following new Associates who have been enrolled since September, 1966:

Mr. and Mrs. H. Hudson Barton
Mrs. Clinton H. Brown
Mrs. Francis Shunk Brown, Jr.
Mrs. Francis J. Carey
Mrs. Eleanor Bugbee Clift
Mrs. George C. Denniston
Mrs. Lee F. Driscoll
Mr. Pierre C. Fraley
Mr. & Mrs. John S. Gates
Mr. Landreth T. Murray
Mrs. Clifford Pemberton
Mr. F. Wallace Tobin
Mr. Robert E. Wright

'Cairo' - - An Illinois Cultivar of Magnolia Grandiflora

Joseph C. McDaniel

University of Illinois, Urbana, Illinois

Though some trees of *Magnolia grandiflora* flower outside as far north in Illinois as Champaign-Urbana, their greatest concentration in this state is in our southernmost city, Cairo, just above the confluence of the Ohio and Mississippi Rivers. Some trees have stood there for a century, at the homes of river boat captains and on the grounds of mansions built in the years just after the Civil War. The *grandiflora* trees in Cairo and in other river towns as far up the Ohio Valley as Charleston, West Virginia, were probably brought in first as seedlings from sources down the Mississippi, where they are native near Natchez and southward. There has since been some natural seed reproduction in southern Illinois towns. Like the wild trees in Mississippi and Louisiana, those in Cairo exhibit a wide range of tree habit, leaf size, shape and glossiness, indumentum color, flower abundance, shape and size, and persistence in flowering.

The clone, which I now register as the cultivar 'Cairo', is distinctive in tree, leaf and flower. It is enough different from the general run of *M. grandiflora* seedlings to suggest that it may have had ancestors brought from even farther away than Louisiana. The leaf forms of 'Cairo' and some of its seedlings considerably resemble those of some trees of the Mexican relative, *M.*

Fig. 55. *M. grandiflora* 'Cairo', freshly opened flower

Fig. 56. *M. grandiflora* 'Cairo', second day, with bees

Schiedeana, one clone of which (a seedling from seeds collected in the Sierra Madre Oriental of northern Tamaulipas by Dr. Frederick G. Meyer) is hardy enough to survive in the University of Washington Arboretum at Seattle. Like *M. grandiflora, M. Schiedeana* has been reported to be a hexaploid with 114 somatic chromosomes. 'Cairo' is very fertile, and is a hexaploid, as judged by the appearance of recent hybrids I have obtained with its pollen in crosses on *M. grandiflora, M. virginiana* and *M. virginiana* var. *australis.* It is registered as a cultivar of *M. grandiflora,* though suspected of having some degree of hybridity with another hexaploid species in the same American section of subgenus *Magnolia.*

The original 'Cairo' tree stands at 2808 Washington Street, Cairo, Illinois, in front of the next house north of "Magnolia Manor." It is of unknown provenance and age, but is estimated to be 80 to 100 years old. In form it is moderately narrow-columnar, rounding toward the top, well covered with evergreen leaves. The leaf blades are thinner and more flexible than usual for *grandiflora,* and generally obovate-acute, somewhat folded up from the midrib, slightly twisted, and depressed at the apex. Their upper surfaces are green and very highly reflective, looking as if just recently polished. The

Fig. 57. Leaves of *M. grandiflora*.
Left 'Charles Dickens', right 'Cairo'.

indumentum of the ventral surface is moderate, light grayish brown, with green showing through and the unrolled margins and midribs are greenish yellow. (Fig. 57)

The flowers, produced from May to July, and until October in favorable seasons, are bowl-shaped, with nine white tepals, more acute tipped than usual for *M. grandiflora*. (Figs. 55 & 56) Flower odor is sweet and moderately strong, not so intense as in 'Alabama Everblooming'. Flower size is average to above average for *M. grandiflora*.

Fruits, maturing from September until late fall, are of medium size for *grandiflora,* tomentose, and develop a red surface color where exposed to the sun, but generally not so deep as red as in the cultivar 'Charles Dickens'. (Fig. 58)

In Cairo, the 'Cairo' tree stands winters with temperatures below 0° F. with little discoloration of foliage, and cutting-reproduced trees of it have stood outside at Washington, D. C. in recent winters. Grafts on *M. grandiflora* stocks are being tested in Mobile County, Alabama, and should be commercially available in another two or three years. For the present, its hardiness north of Cairo and Washington, D. C. is not directly tested, although some seedlings of 'Cairo' parentage are standing central Illinois winters at Urbana and Springfield. It can probably be expected to thrive with adequate care in soils and climates where *M. grandiflora* is commonly cultivated, offering a "cleaner" and less "heavy" appearing tree than is usual in that species. Among three "everblooming" evergreen magnolias selected by me, it makes a larger tree with larger leaves than 'Madison', and a less wide-spreading tree than 'Alabama Everblooming' (both the others selected in northern Alabama).

The one known seedling of 'Cairo' thus far flowered in Cairo has similarly glossy but larger green leaves, a similar growth habit, and produces fewer flowers in a shorter flowering season. The glossiness and distinctive leaf shape of the 'Cairo' are not invariably inherited, but tend to carry over into its progeny, including interspecific hybrids with the two Sweet Bay Magnolia varieties.

Fig. 58. *M. grandiflora* 'Cairo', fruit.

Note: Unlike the Egyptian original, the southern Illinois town's name has the same pronunciation as the Karo brand of corn syrup.

A New Species of Chionanthus

Hui Lin Li

Two species are generally recognized in the genus *Chionanthus* in eastern North America, namely, *C. virginicus* L. and *C. pygmaeus* Small. The former is considered as a variable species occupying a fairly extensive range from southern Pennsylvania to the shores of Tampa Bay in Florida and eastward through the Gulf States to southern Arkansas and the valley of the Brazos River in Texas. The latter is a rarer plant known only from southern Florida.

Among the populations known as *C. virginicus* in the southern part of its range, especially in northern Florida and adjacent regions, there appeared an entity which seems to be distinct from the remaining northern populations. This group is now being proposed here as representing a separate species.

This plant has been recognized first by Mrs. J. Norman Henry, who has repeatedly collected it and studied it first hand in the field for many years. Plants raised from seed collected in northern Florida and grown at Gladwyne, Pa. have flowered and fruited for many seasons offering chances for further observations. Both the natural populations as well as the cultivated specimens seem to show sufficient distinction from typical *C. virginicus* to warrant the recognition as a new species.

Chionanthus Henryae, sp. nov.

Frutex parvus, circiter 1-3 m. altus; foliis coriaceis, ovatis vel oblongis, 5-8 mm. longis, 2-4 cm. latis, apice acutis vel obtusis, basi cuneatis, margine integris undulatis, nervis lateralibus utrinsecus 7-10; petiolis carnosis, 4-6 mm. longis, ad basim atropurpureis; inflorescentiis 8-10 cm. longis, bracteis ad 1.8 cm. longis; calyce 1.5 mm. longo, lobis 4, acutis; corolla 2-3 cm. longa, lobis 4, albis, staminibus 2, filamentis 1 mm. longis, antheris 1.5 mm. longis, connectivo producto, apice obtuso; fructu ovoideo, circiter 1.5-2 cm. longo, 1.5-1.8 cm. crasso.

Shrub, about 1-3 m. tall; branchlets green, changing to brown, glabrous or slightly pubescent when young, becoming glabrous, marked by dark lenticels. Leaves coriaceous, ovate or oblong, 5-8 cm. long, 2-4 cm. broad, the apex acute to obtuse, pointed or rounded at the tip, the base narrowly to broadly wedge-shaped, the margins entire, undulate, yellow-green and lustrous glabrous above, pale and slightly pubescent beneath, the lateral veins 7-10 per side, slightly grooved above, elevated beneath; petioles stout, 4-6 mm. long, dark maroon especially toward the base, slightly pubescent when young, becoming glabrous. Panicles 8-10 cm. long; bracts ovate, to 1.8 cm. long, the upper ones successively smaller. Calyx light green, about 1.5 cm. long, divided into 4 acute lobes. Corolla white, about 2-3 cm. long, divided into 4 narrow strap-shaped divisions, each marked on the inner surface near the base by a purple spot. Stamens 2, the filaments about 1 mm. long, the anthers about 1.5 mm. long, the connectives projected abruptly and blunt-tipped. Stigma 2-lobed. Fruit ovoid, about 1.5-2 cm. long, 1.5-1.8 cm. broad, blackish blue.

Arkansas: Dallas Co., small tree, 6-12 ft. tall, plentiful, growing in thin woods in sandy soil, among pines, 15m. nw. of Fordyce, *M. G. Henry 5158,* April 8, 1948 (ANSP 850171).

Alabama: Corvington Co. ½ m. w. Yellow River, scarce, about 4-6 ft., damp rich soil, edge of woods, *M. G. Henry 3,* October 30, 1962, sterile specimen (MA).

Georgia: Meriwether Co., fragrant white flowers, shrub 3-8 ft. tall, not plentiful, dry hard soil above Wolfden Creek, 2 m. w. of Warm Springs, *M. G. Henry 3966,* April 14, 1945 (ANSP 822255).

Florida: Okaloosa Co., shrub about 6 ft. tall, green fr., scarce, growing on sandy hill above Oak Creek, *M. G. Henry 1626,* June 25, 1939, in fruit (ANSP 786454); Okaloosa Co., deep blue fr., evergreen shrub, 3-4 ft. tall, scarce, growing on dry sandy clay, in sun, w. of Live Oak Creek, *M. G. Henry 1785,* September 15, 1939 (ANSP); Okaloosa Co., white flowers, many-stemmed shrub, 1.5-2 ft. tall, plentiful, growing in sun, in thin sandy oak barrens, 1 m. sw. of Valparaiso, *M. G. Henry 2661,* April 21, 1941 (ANSP 862632); Okaloosa Co., white flowers, many-stemmed shrub, 4-5 ft. tall, plentiful, growing in sandy peat among scrub oaks, 1 m. e. of Niceville, *M. G. Henry 2666,* April 21, 1941 (ANSP 862631); Okaloosa Co., white flowers, clump, 12 ins. tall, plentiful, growing in sun, in dry sandy oak barrens, 3 m. e. of Niceville, *M. G. Henry 2668,* April 21, 1941 (ANSP 862630);

Okaloosa Co., bush 7 ft. tall, growing on dry sandy soil, Live Oak Creek, about 10 m. n. of Mary Esther, *M. G. Henry 2671,* April 21, 1941 (ANSP 862634, holotype), *2673,* April 21, 1941 (ANSP 862633); Tree, 18 ft. tall, scarce, growing on sandy soil, 3 m. w. of Laurel Hill, *M. G. Henry 3154,* October 14, 1941, in fruit (ANSP).

Cultivated Material: Henry Foundation, Gladwyne, Pa., *J. M. Fogg, Jr.,* October 2, 1962, in fruit (MA), *J. M. Fogg, Jr.,* Oct. 2, 1962, sterile specimen (MA), *H. L. Li,* May 21, 1964, in flower (MA).

Abbreviations of herbariums in which specimens are deposited: ANSP = Academy of Natural Sciences of Philadelphia, MA = Morris Arboretum, Philadelphia.

This new species can be distinguished from *C. virginicus* by the consistently smaller leaves, which are more coriaceous, more smoothly surfaced, and with shorter petioles than in the former. The leaves of *C. virginicus* are coarsely reticulate-venulose above. The petioles in the new species are only 4-6 mm. long and darkly maroon colored. In *C. virginicus,* the petioles are usually 1-2.5 cm. long and are generally green throughout. The panicles, flowers and bracts in the new species are generally also smaller than in *C. virginicus* and the anthers are abruptly blunt-tipped and not acuminate as in the latter.

In these vegetative as well as floral features, this new species approaches somewhat *C. pygmaeus.* The latter, however, is of limited range and is confined to the south end of the lake region in Florida. The latter has much smaller leaves, much smaller flowers (corolla 1 cm. long) and larger fruits (2-2.5 cm. long). Furthermore, *C. pygmaeus* is characterized as being a shrub with underground stems. The new species, like *C. virginicus,* is not stoloniferous.

For descriptions of *C. virginicus, C. retusus* and *C. pygmaeus* and bibliographic references to these species, the reader is referred to an article by J. M. Fogg, Jr., "Chionanthus in the Philadelphia area" in this Bulletin, Vol. 11, pp. 3-6. 1960.

The Morris Arboretum 1967 Tour

The Fourth Morris Arboretum Garden Tour will take place in May 1967 and, as in previous years, will be personally conducted by the Director and his wife. The countries to be visited will be Ireland, England, Wales and Scotland. Although a few minor details still remain to be determined, the major events of the tour may be outlined as follows.

The party will leave for Ireland by regularly scheduled jet flight on May 11, will land in Shannon, and, following a day of sightseeing, will spend the night at Limerick. The next two days will be devoted to a motor-coach tour through the "Ring of Kerry" to Killarney. On Monday, May 15, the party will visit the University Botanic Gardens at Cork as well as the large privately owned arboretum of Major and the Hon. Mrs. Bell at Cork Fota Island.

From Cork the group will go by train to Dublin, where arrangements have been made to visit the National Botanic Gardens and Mount Usher, the private garden of Robert Walpole at Ashford, in County Wicklow.

On May 18 the party will fly from Dublin to Liverpool, whence a chartered coach will take us into North Wales to visit the famous garden of the National Trust at Bodnant. From Bodnant we shall drive eastward to Stratford-upon-Avon, spending a full day in the Shakespeare country.

From May 21 to 28 the party will be centered in London from which we shall visit among other places, the Royal Botanic Gardens at Kew, the Gardens of the Royal Horticultural Society at Wisley, the Botanic Garden at Cambridge University and the Chelsea Flower Show.

On May 28 we shall fly from London to Edinburgh where we shall spend two days, visiting the Royal Botanic Garden there as well as several private gardens in the vicinity. Our final stop will be in Glasgow where we shall visit the University Botanic Garden before departing for home on June 1.

Anyone who is interested in further information concerning this tour should communicate with the Morris Arboretum, 9414 Meadowbrook Avenue, Philadelphia 18, Penna.

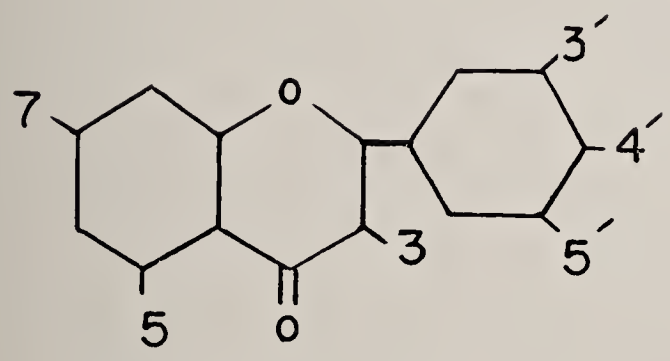
Biochemical Studies in Magnolia IV. Flavonols and Flavones[1]

Frank S. Santamour, Jr.

ABSTRACT

Rutin and isoquercetrin were identified by paper chromatography and ultra-violet absorption spectrophotometry in various tissues of *Magnolia* species. In addition, several flavones, perhaps related to scutellarein, were isolated. Few, if any, of these substances were species specific and the flavonoids are discounted as a major factor in chemotaxonomic studies. The possible role of flavonoids in self- and cross-incompatibility is discussed.

Flavonols and flavones, like the anthocyanins and leucoanthocyanins discussed previously (Santamour 1965 a, b, 1966), belong to the flavonoid group of phenolic substances. The major structural difference between flavonols and flavones and the anthocyanins is the presence of a carbonyl (C=O) group at position 4 (I). Flavones lack the hydroxyl (-OH) group at position 3, which is characteristic of the flavonols.



(I) Basic flavonol-flavone structure

3, 5, 7, 3, 4 — OH	Quercetin: a flavonol
5, 7, 3, 4 — OH	Luteolin: a flavone

As with the anthocyanins, various patterns of hydroxylation and methylation on the basic nucleus are the major features of variation. Flavonols and flavones frequently occur as aglycones but, in perhaps most cases, they are linked with sugars to form glycosides. The sugar substituents of anthocyanins and flavonols of the same plant are usually identical. Sugars may be attached through oxygen (C-O-sugar) as in anthocyanins, although direct carbon to carbon linkages (C-glycosides) are known in the flavones.

Flavonols and flavones may impart some of the yellow, ivory, or cream colors to flower petals, but they may readily be masked by other pigments. Indeed, most yellow flowers owe their color to some other (carotenoid or aurone) pigment system. The yellow autumnal color of certain leaves is almost entirely dependent on carotenoids.

[1] With the support of a grant from the Michaux Fund of the American Philosophical Society.

Biological Significance

Along with other secondary plant products, the flavonoids have long been considered to have no role in plant metabolism or special processess. However, a few papers have been concerned with the possible influence of flavonols in self-and cross-incompatibility. Kuhn and Low (1949) concluded that the inability of two varieties of *Forsythia* to cross-pollinate was associated with the presence of rutin in one pollen and quercetrin in the other. The capability of fertilization was attributed to enzymes capable of hydrolyzing the glycosides. Moewus (1950 a, b) used a similar scheme to explain self-incompatibility in the heterostyled species *Forsythia intermedia*. Reznik (1957) could not demonstrate qualitative or quantitative differences in flavonols between pollen classes of three heterostyled species, and concluded that flavonols were not concerned with self-sterility. The question of the possible role of flavonols in the incompatibility reaction has not been answered completely, and the problem is worthy of further intensive study.

The distribution of flavonols, flavones, and other phenolics has proved remarkably useful in taxonomic studies of some plant groups. Notable among these studies is the work of Alston and Turner (1962, 1963, 1964) on *Baptisia* (family Leguminosae). Working primarily with leaves, they found that a majority of the southeastern species produced species specific phenolic compounds. The use of chemical analyses in combination with morphological studies thus provided a powerful tool in dealing with natural hybridization and introgression. More species specific compounds were frequently found in flowers than in leaves, but the leaves provided a less complicated pattern. Enlightening as these results were, however, the chemical approach to taxonomy can not be applied to all plant genera. Alston (1965) reported that, despite a great amount of interspecific morphological variation and natural and artificial hybridization, no species specific chemical patterns were found in *Oenothera* or *Achimenes*.

The present study was undertaken to determine if the various *Magnolia* species and cultivars contained species specific flavonoid compounds which, if present, would allow the utilization of chemical criteria in taxonomic studies, especially those dealing with hybridization. Furthermore, the study was extended to include the reproductive structures, with the intention of providing some basic information for a further investigation of the role of flavonoids in fertilization.

Previous work on the flavonoids of *Magnolia* has been extremely limited. The only report found was that of Nakaoki *et al* (1956), who reported the presence of rutin in the leaves of *Magnolia obovata*.

Materials and Methods

Plant material (leaves, petals, stigmas, anthers, pollen) was extracted in boiling methanol and the extracts were stored under refrigeration. The extracts were spotted on Whatman No. 1 or No. 3 MM chromatography paper and two-dimensional ascending chromatograms were run with BAW (butanol-acetic acid - water, 4 : 1 : 5, v/v, upper phase) as the first solvent and distilled water as the second solvent.

Some difficulty was encountered in obtaining sufficient concentrations of leaf and pollen extracts to ensure good spotting on the developed chromatograms. For leaves, a technique reported by Berkenkamp (1966) was utilized. A fresh leaf is placed over the chromatography paper and a glass rod is pressed into the leaf tissue, giving a spot of the leaf juices on the paper. Higher concentrations can be achieved by repeating the process at the same location. The technique for pollen was developed by Mr. Rudolph Lucente.[2] After a quantity of extract had been spotted, a small amount of the thick pollen suspension (in methanol) was placed on the spot. This was allowed to dry on the paper and remained there during the development of the chromatogram. Many of the pollens collected during the year had been used up in the course of hybridization work and were not available for chromatographic study.

The spots on the developed chromatograms were examined under visible and ultra-violet light before and after fuming with ammonia vapor. The various spots were further purified and eluted by standard techniques. Ultra-violet absorption spectra of the purified substances were determined with a Carey Model B spectrophotometer. The only control substances available for comparison were rutin (quercetin 3-rhamnoglucoside) and isoquercetrin (quercetin 3-glucoside).

[2] Research Assistant under the Grant.

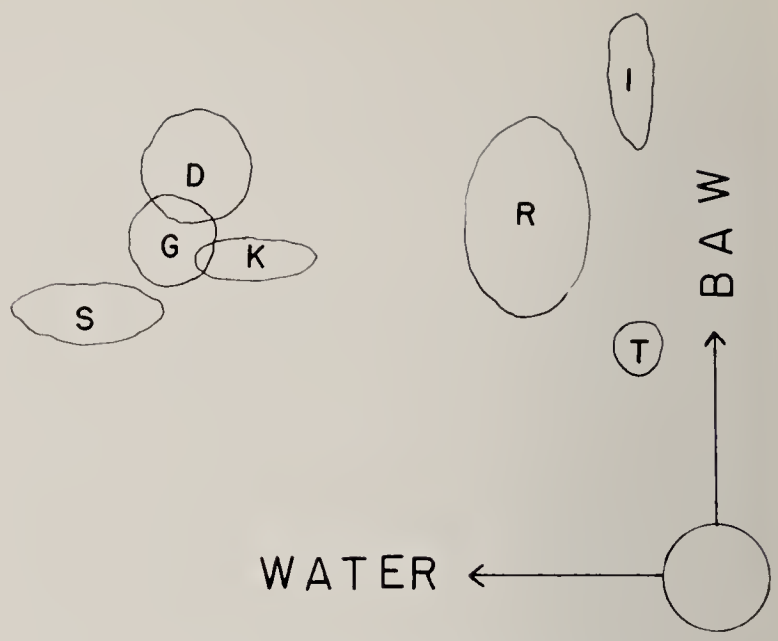


Fig. 59. Composite chromatogram of flavonols and flavones in various tissues of *Magnolia*.

Results

A composite chromatogram, showing all spots found in the entire range of materials, is given in Fig. 59. The designation "R" signifies rutin and "I" is isoquercetrin. The other compounds have not been absolutely identified and the letter designations are simply the first letter of the species in which the substance was initially found.

Table 1 is a compilation of the compounds found in the various tissues of the species and cultivars tested. The data for leaves have been omitted from the table because of wide discrepancies among individual plants of the same species. However, the leaf analysis may be taken up again at a later date.

It can readily be seen from the Table that there are relatively few compounds that might be species specific. Substance G is found primarily in *M. grandiflora* and its hybrids, but also appears to be present in *M. Fraseri*. Substance K seems to be restricted to the stigmas of *M. Kobus, M. stellata,* and the hybrid between them. Substance T is restricted to the petals of *M. tripetala*. No flavonol or flavone could be detected in pollen extracts of *M. Fraseri*.

There may be some question as to why, in a few cases, substance I was detected in the pollen, but not in the pollen-containing anthers. The answer to this question would appear to depend on the relative concentration of the various substances. Pollen makes up a small proportion of the anther tissue and the anthers were extracted under fairly mild conditions. However, the treatment employed in analyzing the pollen (see above) allowed the detection of I.

For the most part, the data given in the Table show that there is a close chemical similarity

between species thought to be closely related on morphological grounds. Thus, the members of the species pairs *stellata-Kobus, acuminata-cordata,* and *Ashei-macrophylla* have similar chemistry.

There were significant chemical differences between the two specimens of *M. liliflora* 'Nigra'; differences in anthocyanins were noted previously (Santamour, 1965 a). The Barnes specimen again seemed very similar to *M. stellata* 'Orchid' and both cultivars may be the result of hybridization between *M. liliflora* and *M. stellata.*

In the *Baptisia* work referred to earlier, it was found that most hybrids represented a chemical composite of species specific compounds from their parental species. Such was not the case in *Magnolia,* where few, if any of the substances were species specific, and where polyploidy was often a factor. The hybrid *M.* × *Loebneri* (*stellata* × *Kobus*) gave a chemical profile virtually identical to its parents but did lack D, which was found in *Kobus* pollen. *M.* × *Thompsoniana* (*virginiana* × *tripetala*), another diploid hybrid, lacked the *tripetala* T and I in its petals and differed in other ways from its parents. *M.* × *Soulangiana* 'Alexandrina' (*liliflora* × *denudata*) also showed some variation from the parental types. It is interesting to note the chemical similarity between an F_2 seedling of *M. grandiflora* 'Dickens' and a man-made F_1 hybrid (Freeman #9) between *virginiana* and *grandiflora*. Both plants showed identical chemical patterns and the only departure from a composite picture was the absence of S in the petals.

Identification of Unknowns

As mentioned before, R and I were identified respectively, as rutin and isoquercetrin. This identification was based on co-chromatography with pure samples and a comparison of ultra-violet absorption spectra. Rutin is the 3-rhamnoglucoside of the flavonol quercetin, and the glycosidic moiety is also found in the anthocyanins (Santamour, 1965a). Removal of the rhamnose from the glycosidic portion of rutin gives isoquercetrin (quercetin 3-glucoside).

The other major substances (D, G, K, S) appear to be flavones. Their ultra-violet absorption spectra in ethanol (G has λ max. 328,298 mu, min. 312,265 mu; S has λ max. 333,284 mu, min. 313,275 mu) suggest that they are derivatives of scutellarein (5:6:7:4′ — tetrahydroxyflavone) and/or its di-methoxy relative pectolinarigenin. Although it is assumed that these compounds are glycosides, they could not be hydrolyzed using normal procedures. It is possible that they are C-glycosides. Substances with the scutellarein-type hydroxylation pattern are rare in nature and further elucidation of the structure of the unknows may be quite informative. Substance T has not been investigated further.

Table 1. Flavonols and flavones in various tissues of Magnolia species

Species or Cultivar	Petal	Anther	Stigma	Pollen
Magnolia				
stellata	R, S	R, S	K, S	—
Kobus	R, S	R, S	K, S	I, R, D
salicifolia	R, S	R, S	S	—
denudata	R, D, S	R, D, S	R, D, S	I, R, D
liliflora (Morris)	S	R, S	I, R, S	R
liliflora (Barnes)	R, S	S	S	—
acuminata	R, D, S	R, D, S	R, D, S	—
cordata	R, D, S	R, D, S	R, D, S	I, R, D
× *Loebneri* 'Merrill'	R, S	R, S	K, S	I, R
× *Soulangiana* 'Alexandrina'	I, R, S	R, S	R, D, S	I, R, D
stellata 'Orchid'	R, S	S	S	—
virginiana	R, S	I, R	R	—
grandiflora	R, G	R, G	R, G	R
virginiana × *grandiflora* (#9)	R, G	I, R, G	R, G	—
grandiflora 'Dickens'	R, G	I, R, G	R, G	—
Ashei	I, R	R	R	—
macrophylla	R	R	R	R
Fraseri	I, R, D, S	I, R, D, S	R, D, G, S	none
obovata	R, S	R, S	R, S	R, D
tripetala	I, R, S, T	R, D, S	R, S	—
× *Thompsoniana*	R, S	R, D, S	R, D, S	—
Sieboldii	R, D, S	R, D, S	S	—

Conclusions

The results of this study indicate that the distribution of flavonoid substances in various organs of *Magnolia* will be of little value in a chemotaxonomic approach to hybridization studies. There are few, if any, species specific substances, and they appear so closely related that the inheritance pattern is erratic.

We can not entirely dismiss however, the possible role of flavonoids in self-sterility phenomena. *M. grandiflora* pollen (containing R) is fully capable of effecting fertilization on its own RG stigmas. The R pollen of *M. liliflora* is ineffective on its own IRS stigmas, but the IRD pollen of *M. denudata* gave a heavy seed set on *M. liliflora*. *M. virginiana* stigmas contain only R, and the R pollen of *M. macrophylla* may bring about fertilization.

Because of the lack of sufficient data, no hypothesis regarding flavonoids and fertilization can be made at the present time. One interesting result of the 1966 hybridization studies was the development of seed on *M. tripetala* following pollination by *M. Fraseri,* the pollen of which contained no detectable flavonoids. Perhaps the presence of enzyme systems capable of glycoside hydrolysis does not necessarily coincide, in the same tissue, with the presence of hydrolyzable substrates.

A combined study of flavonoids and proteins of stigmas and pollen should yield significant data in this regard.

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Arboretum Activities

(Continued from Page 58)

During the fall term Dr. Li offered a new undergraduate course on "Organic Evolution" to students in the Department of Biology.

On October 18 Mr. Dourley met with members of the Weeders Garden Club at the Arboretum and spoke to them on a broad variety of topics which included medicinal plants and some of the basic principles of horticulture.

Fall Planting

Thanks to the abundant rainfall of late September and the mild weather which continued throughout October and into December, our fall transplanting program was a very successful one.

Numerous plants were moved from the nurseries to their permanent places on the grounds and several existing plantings were significantly augmented both by our own material as well as specimens obtained in exchange.

The most ambitious undertaking was the outplanting of a group of about 40 hybrid spruces of known genetic origin. These spruces had been received in 1961 through the generosity of the Northeast Forest Experiment Station (See Morris Arb. Bull. Vol. 12, p. 19). They have been located in a corner of the property to the north of Northwestern Avenue and occupy a strip which extends from near the fence west-

ward toward the Wissahickon Creek. As these trees mature they should form an effective evergreen background for other groups of plants.

About 30 plants of white pine were placed in areas where they will serve to act as wind-breaks, and more than a score of maples (including *Acer japonicum, A. rubrum, A. Ginnala, A. pensylvanicum* and *A. cappadocicum*) were added either to the main maple collection on the farm or to the fall-color area.

A row of a dozen hardy rubber-leaf trees (*Eucommia ulmoides*) were established just inside the fence along Stenton Avenue south of Northwestern Avenue and an equal number of dogwoods were added to our main *Cornus* collection at the foot of the north slope.

Among other groups removed from the nurseries were members of such genera as *Berberis, Calycanthus* (both of which were placed in the fall color area) and *Rhamnus* (three species of which were added to the buckthorn collection.)

The Fifth Barnes Lecture

The fifth in the series of Laura L. Barnes Lectures in Botany and Horticulture will be given by Dr. Frans A. Stafleu, a distinguished member of the faculty of the University of Utrecht. Those persons who were members of the Morris Arboretum European Tour in 1964 will recall that Dr. Stafleu met us at Baarn and conducted us through the fine botanical garden of "Cantonspark."

Dr. Stafleu will speak on the topic "The History of Botanic Gardens and Plant Introductions." His lecture, which will be illustrated, will be held at 8:30 P.M. on Wednesday, March 1, in the Auditorium of the Harriton High School at 600 North Ithan Avenue, Rosemont. Associates and their friends are cordially invited to attend.

J. M. F., Jr.

The Establishment of a Bonsai Collection at the Morris Arboretum

The Morris Arboretum will soon add to its extensive plantings of trees and shrubs a collection of bonsai — miniature trees in containers dwarfed by horticultural techniques as developed in China and Japan. Emphasis will be on providing examples of this unique form of tree culture for educational purposes, illustrating the procedures and results of bonsai techniques.

Existing facilities at the Arboretum will furnish the space for housing and displaying the bonsai needed at this time. If funds are available in the future, it is possible that an especially designed lath house could be built to allow public display of the bonsai while at the same time providing safeguards against loss or damage.

The routine care required including watering, proper light and shade in the growing season and protection during the winter months will be assumed by the staff of the Arboretum while the specialized care such as trimming, re-potting, wiring, etc. will be furnished by interested bonsai growers in the area.

Several gifts of bonsai have been offered as a nucleus of the collection and in 1967 the Arboretum will be prepared to received additional bonsai. Gifts for this purpose are tax deductible. (Because of limitations in both facilities and personnel only finished bonsai can be accepted for the collection).

The Aboretum will also be able to import unusually fine old bonsai from Japan to add to the collection whenever this is financially possible.

The facilities of the Morris Arboretum will be available for bonsai exhibits, lectures and demonstrations. In all matters pertaining to the establishment of this collection the assistance of the Pennsylvania Bonsai Society and other interested groups and individuals will be welcomed and appreciated.

Because of the interest of many Philadelphia area residents the Morris Arboretum will be among the few institutions in the United States with a collection of authentic bonsai available to the public.

Magnolia Wilsonii × M. globosa: A New Hybrid

D. Todd Gresham

Prior to describing this new artificial intra-sectional Oyama hybrid, a brief introduction to the parents may be of interest to those who are not familiar with their characteristics.

Magnolia Wilsonii (Fin. & Gagnep.) Rehd., the seed parent, is a native of wooded areas in E. Sikiang and W. Szechwan and of Northern Yunnan. In common with the other three members of the Oyama Section, ecologically it is a sub-shrub or small tree found on stream margins and in woodland under the shelter of taller trees. *M. Wilsonii* is the most sun-resistant of the Oyama species grown in California.

The natural tendency of this plant is to sucker freely from the base, forming a multiple-trunked shrub. It is important to note that by careful removal of suckers from youthful specimens and judicous pruning, *M. Wilsonii* may be maintained as a beautifully formed small single-trunked tree to 15 or 20 feet. It is practically impossible to achieve this single-trunk form with the other three members of the Oyama Section: *M. globosa* Hook & Thoms., *M. Sieboldii* K. Koch or *M. sinensis* (Rehd. & Wils.) Stapf.

In *M. Wilsonii* the new green growth is pubescent, with rufous indumentum, the bark becoming dark brown by the end of the growing season.

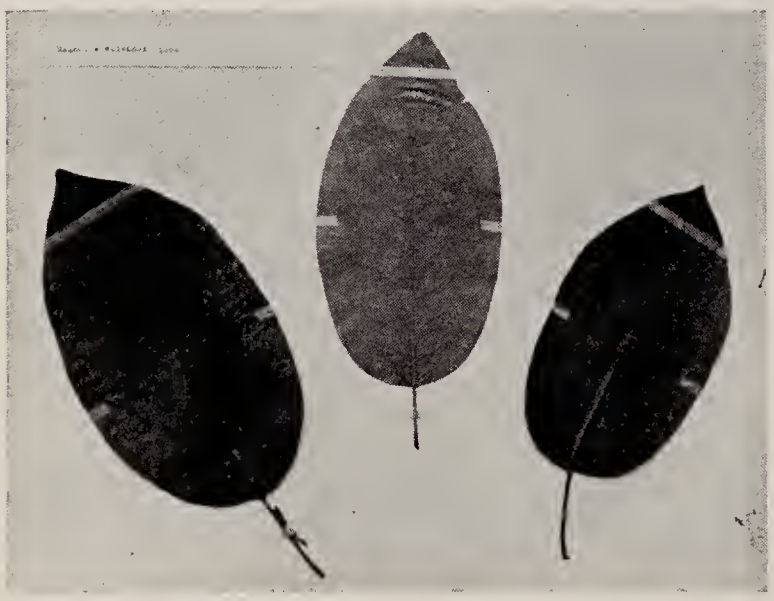

Fig. 60. Leaves of *M. Wilsonii*

Fig. 61. *M. Wilsonii*

The leaf perules are red-brown and the leaves are a dark matt-green of good substance, ovate-elliptic, the apex acute, 6 to 7 inchcs long by 3 to 4 inches wide. (Fig. 60) The leaf-reverse from formation to maturity is clothed in silvery grey indumentum.

The flower buds are ovoid-elliptic and the flowers are white, pleasantly and pervasively fragrant, opening in California during March and April, before the foliage is fully formed. This particular clone produces flowers 6 to 8 inches in diameter, forming at maturity a beautiful bowl-shaped flower with a boss of rose-red stamens. The number of tepals in nine, in three groups of three each. The peduncle is pubescent and the glabrous pedicel is contained, with the flower bud, in a papery spathaceous bract which is pubescent with a rufous indumentum. The

Fig. 62. Leaves of *M. globosa*

extending peduncle positions the opening flower in a completely pendant position. (Fig. 61)

Magnolia globosa, the pollen parent, ranges over a rather extensive geographical area from Sikkim eastward, southeast Tibet, north upper Burma and northwest Yunnan. Here it is a many-trunked shrub with no indication of ever forming a tree. The color of first season's ripened wood is a warm light tan.

The leaves of *M. globosa* are distinctive and perhaps the most beautiful of the genus. They are large, 7 inches long by 4 inches wide, well proportioned, and ovate to elliptic. (Fig. 62). Dark green, glossy, undulate, somewhat reticulated, they appear to be evergreen. The upper surface ribbing is deeply defined, the rib depression filled with gold hairs during the early stage of development. The under surface from formation of embryo leaf to maturity is heavily felted with long red-gold indumentum. The margin of the leaf is ciliate.

M. globosa definitely resents direct sun, preferring filtered shade. The foliage reacts to hot sun immediately by becoming "glassy" and the newly opened buds and flowers burn.

The perules enclosing the flower bud are densely villous with red-gold felting. The spathaceous bract, when released from the last protecting perule is most interesting, reminding one more of a ripening purple fig than a magnolia bud. The bract is glabrous, as are also the pedicel and penduncle. The peduncle extends slightly above horizontal and this is the final blooming position of flower.

The flowers are globe-shaped, the tepals 9-10, the outer three of which might be termed sepals as they are distinct and at maturity elevated from the globe. The blossom retains a globe form through maturity, never fully expanding.

Fig. 64. Leaves of *M. Wilsonii* × *M. globosa*

Fig. 63. *M. globosa* (Chinese form)

(Fig. 63) The gynoecium is green, large and globular and the anthers are darker than those of *M. Wilsonii*. The flowers are slightly fragrant.

To correlate a hybrid with two distinctly differing parents never ceases to engender a feeling of wonder for the action of their genes in producing a unique individual. Observing the embodiment of these briefly related parental characters unfold in the hybrid has been most interesting during the past few years and now the *summa bonum* impatiently awaited has been realized — the blossom. May time evaluate this cross of sufficient value to warrant perpetuation and provide lasting pleasure for many magnolia enthusiasts!

Structurally the plant is tree-like, well clothed and exhibiting hybrid vigor; aesthetically the

Fig. 65. *M. Wilsonii* × *M. globosa.* Photo fram drawing

flower is pleasant in fragrance, carriage, and form. The new growth of *M. Wilsonii* × *M. globosa* resembles *M. Wilsonii,* covered with rufous indumentum. The ripened wood at the season's end favors *M. globosa*: a warm tan.

The leaves are a dark matt green as in *M. Wilsonii,* but larger and heavier, ovate- elliptic, the apex acute, 7½ inches long by 4 inches wide. (Fig. 64). The leaf-reverse from forma-

Fig. 66. Young plant of *M. Wilsonii* × *M. globosa*

Summary of the foregoing information for easy comparison of transmitted characters in the hybrid, *M. Wilsonii* × *M. globosa:*

	M. WILSONII	*M. GLOBOSA*	*HYBRID*
Habit	Treelike	Shrub	Treelike
	Brown Wood	Tan Wood	Tan Wood
Leaves	Matt	Glossy	Matt
	Ovate-elliptic	Ovate to elliptic	Ovate-elliptic
	Apex acute	Apex apiculate	Apex acute
	Reverse and ribs grey pubescent	Reverse and ribs red gold-pubescent	Reverse and ribs gold-pubescent
	Sun resistant	Sun burn	Sun resistant
	Growth early	Growth late	Growth late
Flowers	Bud ovoid-elliptic	Bud globose	Bud ovoid-elliptic
	Papery bract rufous villous	Bract purple, glabrous	Papery bract rufous villous
	Pedicel, peduncle pubescent	Pedicel, peduncle, glabrous	Pedicel glabrous, peduncle pubescent
	Bloom: March, April	Bloom: June	Bloom: June
	Flower pendant	Flower slightly above horizontal	Flower slightly below horizontal
	White bowl	White globe	White cup
	9 tepals	9-10 tepals	9 tepals
	Rose-red stamens	Dark rose-red stamens	Dark maroon-red stamens
	Green gynoecium, ovoid-elliptic	Green gynoecium, globose	Green gynoecium, globose
	Very fragrant	Slight fragrance	Closer to *M. Wilsonii*

Note: The plant described was flowered in a 5-gallon can. (Fig. 66) No doubt open ground planting will produce more vigor.

tion to maturity shows the mid-rib and veining covered with long red-gold hairs, the edges ciliate as in *M. globosa*. Resistance to sun less than in *M. Wilsonii*.

The perule enclosing the ovoid-elliptic flower bud and papery spathaceous bract is covered with red-gold pubsecence. The pedicel is glabrous and the peduncle pubescent. The latter assumes a goose-neck shape to position the flower slightly below the horizontal. The fully open flower faces outward, exposing the large globe-shaped green gynoecium, white stigmas, and heavy boss of dark maroon-red anthers.

Fortunately the mating has produced a regular, well proportioned combination of tepals, numbering nine, in three sets of three each. The inner six ovate tepals are uniquely boat-shaped, rather than flattened, giving the blossom dimension. The flower is a fully opened cup, 4 inches in diameter and of heavier substance than *M. Wilsonii,* nearer to *M. globosa.* (Fig. 65). The pleasing tepal formation is not a characteristic of either parent, but is evident in *M. Sieboldii*. However ,the tepals of *M. Sieboldii* are obtuse whereas those of the hybrid are acute.

Numerous inter- and intra- Oyama crosses have been accomplished here. The entire section and hybrid progeny should be better known and more widely planted. Other individuals of the *M. Wilsonii* × *M. globosa* cross under breeding numbers 3 X 60; 97 X 62; 24 X 61, have been planted out in Gloster Arboretum, Gloster, Mississippi, by Mr. and Mrs. Frank W. Gladney.

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* Gift of Mrs. Edward M. Cheston

** Gift of Mrs. E. F. Rivinus

Associates' Corner

Thanksgiving Day at Friendship Creek

At the Morris Arboretum one encounters not only the gardens of Spain and the mountains of western China but also the Pine Barrens of New Jersey. There is, as it were, a smell of pine needles in the very air inside the main building, and one sees a glint in the eyes of people who speak of it that betrays their addiction to the place.

The Pine Barrens. An oblong tract of land in the southeastern part of the state, about 65 miles long and 30 wide. It is flat, and largely covered by a forest of pitch pine and oak. Through these woods flow streams, most of them in an easterly or south-easterly direction toward the sea. Their water is the color of pale coffee, being dyed with organic matter accumulated in the cedar swamps through which they run.

Many Pine Barren plants are found only rarely in other places; a few occur only here. For this reason the area has become a Mecca for botanists for more than two centuries. From far and near they have come to explore, their wheels often deep in sand, then, when cart or car could go no farther, scrambling down railroad embankments and sloshing through swamps. Young enthusiasts, as well as grave and learned botanists have searched wet mossy spots, where they might be lucky enough to find that rare curly-grass fern *Schizaea pusilla,* or hoping in some quaking white cedar bog to come upon a glowing mass of gold-crest (*Lophiola aurea*).

Friendship Creek is one of the few streams that flow northward, into the Rancocas, thence into the Delaware. It is easy to reach from Philadelphia, being less than fifty miles away.

On Thanksgiving Day I decided to go there with a young friend. We took the Pennsylvania Turnpike, the New Jersey Turnpike and Route 206 to Red Lion Circle. From there Route 70 goes east to the "Friendship" area.

Two small bridges over Friendship Creek are less than two miles from the Circle, but long before that we stopped the car and knelt by a ditch that runs along in front of a dark woods. In this narrow strip of wetness November is as fresh and green as May. In a few square feet one can see (and feel) dripping sphagnum; trailing cranberry stems with unfrozen fruit still good to eat; tiny red buds of sand myrtle (*Leiophyllum buxifolium*), that lovely small evergreen heath of the Barrens; wintergreen (*Gaultheria procumbens*), its dark red leaves here close to the ground; a partridge-berry with still a red berry or so; white cedar seedlings one or two inches tall, and here and there a patch of pyxie (*Pyxidanthera barbulata*), its starry rosettes of green or red leaves hardy through the winter, ready now for spring.

What more could one ask? But more there is. Back against the trees on the very edge of the woods a high bush blueberry with a few scarlet leaves left on; swamp sweet azalea (*Rhododendron viscosum*) adorned now only with its buds; sheep laurel; a bit of bayberry, sweet pepperbush (*Clethra alnifolia*) and a struggling holly (*Ilex opaca*). Then the young gray birches (*Betula populifolia*) looking very white against the dark trunks of *Pinus rigida,* the ever-present pitch pine of the Barrens.

We pushed slowly on to Friendship Creek where a few years back two clear streams flowed under the road but where now is a desolate waste. Perhaps some misguided cranberry grower downstream flooded his bogs in such a way that the water backed up and drowned these trees; we do not know. But where there was clear water and lush growth is now a scene of death and destruction. We hurried past.

About a half mile beyond the second bridge a sandy road on the right leads into the woods. We drove in as far as we could without getting into deep sand, keeping an eye out for a turning-around place. On the left as we went in was a fine stand of turkeybeard (*Xerophyllum asphodeloides*). In May its tall spikes of white flowers light up the woods, but in spring there is heavy competition from things around it. Now the brown stalks with their shapely heads stand alone. Probably the first winter storm will bring them down; this is their last appearance.

Having found a good stopping place we left the car and tried to learn a few of the oaks that characterized this area. We took a twig with its dried leaves from two of the trees which proved later to be *Quercus marilandica* (Black Jack) and *Q. stellata* (Post Oak). But my companion was hungry, so we walked up a sandy slope to a place where the creek could be seen in its natural state in all its natural loveliness. Clear brown water flowing between white sandy banks, gray birches along the opposite bank as far as we could see, and on this side lower growth with open spaces for sunshine.

After lunch we explored an abandoned cranberry bog close by. Many of the dykes were either broken down or thickly overgrown, although some were strong enough to walk on and provided a rich field for study. But the Barrens have a way of conveying to people who go there some of their own tempo, which is slow, lazy, and good for the soul. We lingered on. It was very quiet. No sound of cars reached us from the highway. A bluejay spoke from a distance, a song sparrow from a bush nearby. The oak leaves made their own dry, brittle, impersonal sounds. The pine needles had a softer music in the tops of the trees. A turkey vulture was gliding in the blue and white sky, in no hurry at all.

Within arm's reach was "reindeer moss" — not a moss but a lichen — and plenty of *Hudsonia cricoides,* the Pine Barren heather. If one wishes to become acquainted with the Heath Family the thing to do is first to study it in the Heath Garden at the Arboretum and then go to the Barrens and see it growing wild. We had already found seven species and now a few feet away was another, though we did not know what it was until later. Bunches of light brown seed-pods, that was all, but they had an air of distinction, and proved to be *Lyonia ligustrina,* or male-berry. Lying on the ground nearby was a bunch of gray seed-pods that rattled like some tiny ancient instrument. We took it home: *Baptisia tinctoria,* or yellow false indigo, of the Pea Family.

There was time to look around at the display of color. The sand we sat on was gray-white in some places, deep orange in others. At the edge of the water, more sphagnum and the greenest of mosses. Sheep laurel had orange and red and green leaves on one stem. Late sunlight was streaking through a long vine of green-brier, turning each separate leaf into a glowing ruby. At last we took a few steps along one of the dykes, just to see what we were missing, then made for the car and home.

Glancing at what we had in the back of the car I wondered how long it would take to find out what some of our treasures are. Perhaps it would even involve the use of a KEY — that device that someone invented to trap the unwary and confound the already confused. Then I thankfully remembered the Arboretum, where no one is ever too busy to stop and give a helping hand to the ignorant ones.

As we drove past the dairy farms of New Jersey with their herds and their silos, and into Pennsylvania, where a pleasant countryside is being invaded by crowded towns and industrial parks, we said: "We have been to another world."

PHOEBE CROSBY

ERRATA

P. 14 right, line 7 for nycteis read *nycteis*
P. 27 left, line 13 add "ago"
P. 51 left, line 15 for *Bartr.* read Bartr.

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